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ALEXANDER AGASSIZ: HIS LIFE AND SCIENTIFIC WORK[1]

ALEXANDER AGASSIZ, our distinguished alumnus and my friend, died at sea in mid-ocean on board the S. S. *Adriatic* on Easter morning, March 27, 1910. When this information was received in England by wireless message, it was believed that some mistake had been made, for only a few days previously he had parted with scientific friends in London apparently in most excellent health. The sad news was too speedily confirmed. A few days later I had occasion to speak before an assemblage of scientific men and oceanographers, and I said his death was a great loss to American science, to the science of oceanography, and to all people who take an interest in the progress of natural knowledge. On this occasion I propose to show that this statement was fully justified, and that a truly great man passed from the world when Alexander Agassiz died.

Alexander Agassiz was the only son of the famous naturalist, Louis Agassiz, by his first wife, Cecile Braun, and was born at Neuchâtel in Switzerland on December 17, 1835. His school days were spent at his birthplace and at the Bürger School at Freiburg, in Baden, Germany, where his maternal uncle was a professor in the university, where his mother and sisters then resided, and where he also came under the influence of a great biologist, Professor Theo. von Siebold. Here were laid the foundations of an education in the French

[1] Memorial address delivered in Sanders Theater, Cambridge, Mass., March 22, 1911, at the request of the president and fellows of Harvard College. Reprinted from the Bulletin of the Museum of Comparative Zoology at Harvard College.

and German languages and in science, which proved a great advantage in his future career. His mother was an artist, and we have hints that her temperament was very different from the placid uniformity which is said to have been characteristic of his father. The father and son are said by Dr. Walcott, who knew them both well, to have apparently belonged to absolutely different types.[2] When I sometimes observed outbursts of indignation, and impatience in Alexander Agassiz, I was always reminded of a passage in the quarrel between Cassius and Brutus in the play of Julius Cæsar.

Cassius exclaims:

Have you not love enough to bear with me,
When that rash humor which my mother gave me
Makes me forgetful?

And Brutus replies,

Yes, Cassius; and from henceforth,
When you are over-earnest with your Brutus,
He'll think your mother chides, and leave you so.

In 1849, at the age of thirteen years, the young Agassiz joined his father in America, and his later education took place at Harvard College and the Lawrence Scientific School at Cambridge, Mass., where the elder Agassiz occupied the chair of natural history. He used to refer with much pleasure and satisfaction to the manner in which he was befriended, soon after his arrival in the country, by Augustus Lowell, the father of our President Lowell. In 1855 Alexander Agassiz graduated at Harvard. Two years later he took the degree of S.B. in civil engineering, and later a second S.B. degree in natural history. Between 1856 and 1859 he taught in the Agassiz School, and here it was he first met, as a pupil, the young lady who was to become his wife. In 1859 he was appointed an assistant in the United States Coast Survey, and worked in California and Washington Territory.

[2] *Boston Evening Transcript*, April 6, 1910.

In 1860, at the age of twenty-six, he married Anna Russell. It was a love match, and the young couple started out with a very slender income. In the same year Agassiz was appointed assistant zoologist in the Museum of Comparative Zoology at Cambridge, founded by his father. His connection with this institution lasted as long as he lived—a full half century. During half of that period he acted as curator, succeeding his father. On resigning the curatorship in September, 1898, he served on the faculty of the museum as secretary. In 1902 he was made director of the University Museum.

In 1863 Agassiz became interested in coal mining in Pennsylvania, but afterwards turned his attention to the copper mines of Lake Superior, acting as superintendent of the Calumet and Hecla mines from March, 1867, to October, 1868. It was in consequence of his ability, attention, devotion and business habits that these mines turned out a great financial success at a later date. Up to the time of his death he was president of this successful company.

In 1869 he had a severe illness at Cambridge from the effects of over-work, anxiety and exposure at Calumet, from which it is believed he never fully recovered. The years immediately preceding this illness had been full of all the financial and other worries connected with mine superintendence and the care of a large and growing business. Still even at this busy period we find the dominant note of Alexander Agassiz's life continuously sounded—the desire to add to the sum of natural knowledge.

As a boy he had accompanied his father on his cruise in the *Bibb* off Nantucket, and in 1851 he aided in the survey of the Florida Reefs. Before he had reached the age of thirty over twenty publications had

appeared from his pen in various American scientific journals, the subjects ranging from the flight of lepidoptera and beaver dams to the position of sandstones on the shores of Lake Superior, and zoological classification.

The great majority, however, of these papers deal with marine organisms, such as medusæ, salpæ, annelids, actinæ, echinoderms and various pelagic larvæ. These papers, as well as the fact that he published in 1865, conjointly with his stepmother, Mrs. E. C. Agassiz, a popular book on marine life entitled "Seaside Studies in Natural History," show that even in his early career he was fascinated by the ocean, its myriad inhabitants and their conditions of existence. It could not well be otherwise, considering the intellectual atmosphere by which he was surrounded. He took a keen interest in the explorations of his friend, Pourtalès, off the coasts of Florida, and assisted in the description of his collections. In fact Agassiz's early manhood coincided with the great renewal of interest in the physical and biological conditions of the great ocean basins. Maury and Brooke had taught men how to sound correctly the deep sea, and Maury had published his "Physical Geography of the Sea" and a depth chart of the whole North Atlantic. Bailey had examined microscopically the deep-sea deposits under the gulf stream; Pourtalès had discussed the formation of green-sand in the same deposits, and the older Agassiz had pointed out the bearing of these new facts on the question of the permanence of continents and ocean basins. The observations of Lovén and Michael Sars had shown that, if there was a zero of life in the great oceans, it must lie at a much greater depth than Forbes had indicated from his observations in the Mediterranean. Wallich, Huxley and Haeckel had expounded their views on the habitat of the Globigerinæ, the shells of which covered the floor of the ocean, and of some organisms brought up from a great depth on sounding lines. The renowned "Bathybius" had been described as a living carpet on the ocean-floor and was accepted by the scientific world. Wyville Thomson, Jeffreys and Carpenter had conducted deep-sea explorations in the *Lightning, Porcupine* and *Shearwater,* capturing in great depths crinoids, irregular sea urchins and other marine creatures which were reminiscent of fossil forms.

All these fresh and striking facts, and the speculations connected therewith, must have been present in the mind of the young naturalist when recovering from his severe illness in 1869. One can well imagine how earnestly he desired to take an active part in the new explorations and investigations which were either then being carried out or were projected for the near future. At this time an unexpected occurrence enabled him to realize a long wished-for opportunity of visiting and examining the echini collections in European museums and of becoming personally acquainted with the British naturalists then engaged in oceanographical work and deep-sea exploration. One day when recovering from his illness he chanced to meet his friend, Mr. James Lawrence, of Boston. Lawrence remarked, "How ill you are looking!" and Agassiz replied that he thought he was dying. "Nonsense," said Lawrence, "what you need is rest and change of scene." "I can not afford it," was the reply. "Oh yes! you can," said Lawrence, "I'll be your banker." Agassiz never referred to this incident without emotion. He always felt that he owed his life to Mr. Lawrence.

Mr. and Mrs. Agassiz sailed for Europe in the autumn of 1869, with their children

and were absent from Boston for fully a year. This was a period of convalescence and of great pleasure and enjoyment; it was also a period of great activity and hard work. His first visit was to Wyville Thomson, who was then professor at Belfast, in Ireland. Years previously they had been in correspondence about the distribution and development of echinoderms, and Agassiz was, of course, anxious to see him and to learn all about the *Lightning* and *Porcupine* expeditions, in which Wyville Thomson had taken part, and concerning which he had just published a statement of results. The subsequent correspondence shows that this, as well as another visit towards the end of 1870, gave the greatest satisfaction to both naturalists as well as to their wives. Agassiz then proceeded to visit and examine the echini collections in nearly every museum in Europe. The great majority of the original type specimens described by the principal writers on the subject during the nineteeth century thus passed through his hands and were critically compared with specimens from the Museum of Comparative Zoology in Cambridge and from the recent deep-sea expeditions. A few extracts from his own letters will best indicate his progress, occupations and impressions during this visit to Europe.

Wyville Thomson had written to Agassiz after his visit to Belfast that he had lost or mislaid some deep-sea specimen, and Agassiz, jocularly, replied from London, assuring him that he had "taken nothing away from Ireland except a bad cold."

From Copenhagen he writes to Wyville Thomson: "What a pleasant place this is! My wife wishes me to send her kindest regards to Mrs. Thomson and yourself. I am here after a most successful trip through Germany, and am on my way to Stockholm. By the time I get through, we shall have been in every place where there is anything to be seen in the way of type echinoderms. I am getting on famously as far as the material for the echini catalogue is concerned. In Berlin I saw many nice things from Japan. I am just finishing the echinoids here with Lütken, who is a most charming fellow. . . ."

From Switzerland (Leuk, August 8, 1870) he writes: "I have done now with my examination of the Echini collections, having now seen them all, and I hope I shall not be prevented from getting out my catalogue very rapidly after my return home."

From Lausanne (August 23, 1870) he again writes to Wyville Thomson: "We have just come back from a charming trip to the mountains, had pleasant weather the whole time, besides doing us all a great deal of good. I am happy to say I am now picking up fast, and if I keep up at the present rate trust to be perfectly well this fall when I go home. We hope to be in London last part of October. We sail 8th November, and I shall manage if possible to take a run to Belfast and see what you have got (that is from the *Porcupine* expedition.) . . . I hope you will have the best of luck on your new trip, and find something more astounding than Rhizocrinus, Pourtalèsia or Calveria. Mrs. Agassiz wishes me to thank you very much for your kind invitation, and to send her kindest remembrances to yourself and Mrs. Thomson."

Here are some extracts from his letters immediately after his arrival at home:

"We had a capital passage; except two days when it was rough, it was quite pleasant, the whole not lasting more than a little over eight days from Queenstown, which for the season was admirable. I found father much better than I had hoped

to see him again. He manages to come to the museum for an hour or so a day, sees a few of his friends every day, and keeps going just enough to be employed. He improves daily, and I see no reason why he should not have a long period of usefulness yet, though of course nothing like his old work can now be expected from him again. . . ."

In March, 1871, he writes (from Cambridge)—"I am just getting out a new edition of the Seaside Studies, which will, however, be a mere reprint"—and in March, 1872: "I hope you will accept the offer to go round the globe, and if you go may you get all the antediluvial things left. I am greatly afraid father's expedition is not going to result as well as we hoped; the vessel is a great disappointment, five weeks out of ten they have spent repairing. They have left Rio, and the next mail trust to hear from them in the Straits of Magellan."

In April, 1872, he says: "Don't be alarmed by the number of my epistles. But I wanted to acknowledge at once the safe arrival of the 'Calveria' and of the 'Phormosoma.' I need not tell you how greatly obliged I am to you. . . ."

The "Revision of the Echini"[3] began to appear the year after his return from Europe. This is the best known of the works of Alexander Agassiz and at once stamped the writer as the leading authority on the subject. Part I. deals with the literature, nomenclature, synonymy and geographical distribution of the echini, and extends to 242 pages. Part II. deals with the echini of the east coast of the United States, including a report on the deep-sea echini collected in the Straits of Florida by Pourtalès in 1867–1869, and extends to 136 pages. Part III. contains the descriptions of the species of recent echini, and extends to 251 pages. Part IV. deals with the structure and embryology of the echini, and extends to 141 pages. The text thus occupies 770 quarto pages, and is illustrated by seven maps showing the geographical distribution and 87 plates giving full figures and details, in addition to numerous wood-cuts in the text. This report represents an immense amount of work and close study, and it became the standard for all subsequent investigations dealing with this class of animals.

Agassiz throughout his active scientific life was a constant student of echinoderms. He worked on starfishes and crinoids, but the principal object of his interest was the recent echini. His first publication on this fascinating group of animals was in 1863, and his last in 1909, covering a term of forty-six years, a long period of sustained interest and work. He described a considerable part of the deep-sea species and genera known to science in his monographs on the deep-sea echini collected by the *Challenger, Blake* and *Albatross* expeditions. He described as new, about one third of the known recent echini, of which there are some 450 species.

In addition to systematic work, he published on the development and morphology of echini as well as on their geographical and bathymetrical distribution. His work was almost wholly on recent forms, but in several of his works, especially the revision, and *Challenger* report, there is discussion of, and some observations on, fossil echini.

The three years immediately succeeding his return from Europe in December,

[3] "Revision of the Echini," Illustr. Cat. Mus. Comp. Zool. (Cambridge, Mass.), No. VII., 1872–1874; by Alexander Agassiz. It was divided into four parts for purposes of publication; Parts I. and II. were issued together in 1872, the introduction being dated August, 1872, Part III. in September, 1873, and Part IV. in January, 1874.

1870, were the most active, fruitful and enjoyable of his whole life. His financial position had greatly improved and his mind was crowded with new schemes and new ideas with reference to the study of the ocean. He visited the *Challenger* expedition when the ship reached Halifax in May, 1873. He was enthusiastic about our captures, and he could teach us much we did not know, especially about echinoderm and annelid larvæ. I remember he showed us how he had proved that *Tornaria* was the larva of *Balanoglossus*. All the younger men of the expedition were pronounced evolutionists or Darwinists, and the name of Agassiz conjured up opposition to such views, but the impression made by Alexander Agassiz was excellent in every direction, the general judgment being that the younger Agassiz was a very different man from his distinguished father. It was freely prophesied that he would have a very brilliant scientific future. He was buoyant, cheerful, confident and possessed a fund of dry humor. He was rather above medium height, with brown eyes and dark complexion. He had a fine presence, dignified bearing and gracious manners. The following note received on board the *Challenger* some months after his visits indicates conscious capacity and the overflowing joy of life: "We are all flourishing here after a very successful summer at Penikese, about which you must have seen plenty in the papers. The museum is getting fuller than an egg, and I don't know what we shall do for room. We have just secured the collection of Wachsmuth—the finest collection of *crinoids* there is from the west, and with what we have, our collection is now superb. I shall attack them soon I hope." (Cambridge, October 24, 1873.)

The scene, the outlook on life, was suddenly changed. His father, Louis Agassiz, died on December 14, 1873. His beloved wife, Anna Russell, who had tenderly nursed and watched at the bed-side of her father-in-law during his last illness, caught cold from exposure on the night of his death, and died from pneumonia within ten days thereafter.

This was a terrible blow to Alexander Agassiz. The light and brightness of his life had suddenly been extinguished. A cloud fell upon him which nothing on this earth could completely clear away. His mental attitude towards the future is plainly stated in a letter written from Peru in March, 1875, and received on board the *Challenger* when we were voyaging in the Pacific. It evoked the deep sympathy of the *Challenger* naturalists. He says:

> I hear of your whereabouts through the papers occasionally, though lately I have not seen anything concerning your movements, as I have been wandering about in Chili and Peru, out of the way of all newspapers. I could not stand the associations of my house after the terrible ordeal I had to pass through, and for about five months I have been listlessly running from place to place trying to wake up an interest in outside matters. It is all well enough as long as I am on the move, and there is the excitement of constantly seeing new things and new people, but when I am settled down for any length of time, and attempt to do any continuous work, it is impossible for me to throw off my troubles, and life seems unendurable. Yet I can not deny that I have had a great deal of pleasure on my trip to South America, and under ordinary circumstances it would have been to me a great store of future enjoyment. As it is I look upon it as so much time passed, and really dread the moment when I shall reach home, or rather my house, for no place can henceforth be a home to me.

Even here, however, what I have called the dominant note of his life—the desire to get new knowledge—rings out strongly, for the rest of this distressful letter is taken up with a detailed description of his

exploration of Lake Titicaca. He had taken his museum assistant with him to help in making collections for the museum at Cambridge; he had chartered the only available vessel, had taken water and air temperatures, had dredged and tow-netted and constructed a bathymetrical chart of this elevated lake, 12,500 feet above sea level—altogether a most interesting description from all points of view.

The Alexander Agassiz before the death of his wife in 1873 was, in my opinion, a very different man from the Alexander Agassiz after that sad event. The first Alexander Agassiz I had seen, but I knew him only very slightly. I have pictured him as he appears to me from his correspondence, from what I have heard from his intimates, and from his own lips. The second Alexander Agassiz I knew well, long and intimately; he was during the last thirty-four years one of my most intimate and valued scientific friends.

During his visit to the *Challenger* at Halifax he promised to come to England on the return of the expedition to see our deep-sea treasures. When he arrived in Edinburgh I referred to the death of his wife, but he held up his hands and said, "I can not bear it." His expression was such that the subject was never again mentioned, although he frequently spoke about his boys. He spent fully two months in Edinburgh, but would not at that time attend any social functions. Every day from early morning till as long as day-light lasted he assisted me in opening boxes and bottles and in separating out the various groups of marine organisms, especially selecting the echini, which he was to take to America, having consented to describe this group of organisms for the report on the scientific results of the expedition. While this work was going on we had abundant opportunity for discussing the work and results of the expedition and every aspect of the new science of the sea. I was relatively young, and often recounted to him the comic and other incidents of the voyage, and he would smile and seem amused. His attitude was, however, in striking contrast to the boisterous merriment of Haeckel when engaged with me in the same place and in similar occupations. On the conclusion of his visit he wrote to Wyville Thomson on January 23, 1877:

> I can't tell you what a pleasant time I have had in Edinburgh, thanks to you and Lady Thomson. It is really the first time since the death of father and my wife that I have felt in the least as if there were anything to live for, and I hope you have put me on the track to get into harness again and do my share of the work I have to do, if not with pleasure, at least cheerfully.

During the last thirty-five years of his life Alexander Agassiz's activities and interests were many and varied. The control and direction of the Calumet and Hecla mines demanded frequent visits to the west, and there we find him conducting valuable experiments in the distribution of underground temperatures in the great depths of the mine. We also find him producing carbonic acid gas to put out a disastrous fire in the mines—said to be the first time this method was thus employed on a large scale.

The first American attempt to found a zoological station at Penikese having failed, he established a zoological laboratory at Newport to take its place, equipping it with all the necessary appliances and accommodations for twelve students. This institution was carried on for twenty-five years—till it was no longer necessary owing to the establishment of the Woods Hole Marine Biological Station.

The important series of oceanographical or deep-sea investigations with which his name is so closely associated have won for

him the gratitude of all subsequent generations of scientific workers. He directed three expeditions in the Atlantic in the U. S. S. *Blake,* and three in the Pacific in the U. S. S. *Albatross.* These dealt especially with the deep-sea, and yielded an immense number of new organisms and new observations concerning the physical, chemical, biological and geological conditions of the great ocean basins. Agassiz, being a practical engineer, was able to suggest many improvements in deep-sea instruments and methods; the wire rope for dredging and a modified trawl for deep-sea work were among these improvements. The general account of the Atlantic expeditions is published in two volumes entitled "Three Cruises of the *Blake,*" and the general accounts of the Pacific expeditions are to be found in the bulletins and memoirs of the Museum of Comparative Zoology. It would be difficult to overestimate the value of the zoological and other collections amassed during these most excellent and extensive explorations.

If we can say that we now know the physical and biological conditions of the great ocean basins in their broad general outlines—and I believe we can do so—the present state of our knowledge is due to the combined work and observations of a great many men belonging to many nationalities, but most probably more to the work and inspiration of Alexander Agassiz than to any other single man. Agassiz's researches in the Atlantic resulted in very definite knowledge concerning the submarine topography of the West Indian region and of the animals inhabiting these seas at all depths—probably we know more of this submarine area than of any other area of equal extent in the world because of his explorations. He arrived at the general result that the deep-sea animals of the Gulf of Panama were more closely allied to those in the deep waters of the Caribbean Sea than the Caribbean forms were to those of the deep Atlantic. Hence he concluded that the Caribbean Sea was at one time a bay of the Pacific Ocean, and that since Cretaceous times it had been cut off from the Pacific by the uprise of the Isthmus of Panama.

When the *Challenger* expedition carried her explorations down through the central southern Pacific, she found a rather puzzling state of things. In deep water relatively very few animals were captured on the bottom of the ocean when compared with those taken in the great southern ocean or nearer continental shores; those obtained were, however, of rather pronounced archaic types. The deposits in the same area were of surpassing interest; large quantities of a deep-brown clay were hauled up, in which were imbedded enormous numbers of manganese nodules and concretions, some of them being formed around sharks' teeth, ear bones and other bones of whales, and others around volcanic fragments mostly converted into palagonite. Sometimes hundreds of sharks' teeth and dozens of whales' ear bones were captured in a single haul, and most of them belonged to extinct species. Small zeolitic crystals and crystal balls were also mixed up in these red-brown clays, evidently formed *in situ.* More extraordinary still were the minute spherules having a hard black coating and an interior of pure iron and nickel, as well as other minute spherules, called chondres, found hitherto only in meteorites. These spherules are believed to have an extra-terrestrial origin, and to have formed at one time the tails of meteorites or falling stars. This was a strange assemblage of things, and some scientific men argued that such a condition of matters must be regarded as local and accidental.

Now Alexander Agassiz explored anew this region of the earth's surface the furthest removed from the shores of continental land, and he found that the same condition of things extended over vast areas of the Pacific Ocean. Here we have almost certainly the region of minimum accumulation on the sea-floor, and recent investigations indicate that there is in these deep deposits more radio-active matter than anywhere else in the solid crust of our planet. A satisfactory and clear understanding of the phenomena has not yet been obtained, but Agassiz's researches take us a long way on the road to a solution of some exceedingly interesting and important oceanic problems.

During the last thirty years of his life, Agassiz became very greatly interested in all coral-reef problems, and organized very many extended expeditions, almost entirely at his own expense, with the view of studying coral reefs, coral islands, and upraised coral formations. It would be wearisome to give even an abstract of all the publications by himself and his assistants dealing more or less directly with these subjects. It can truly be said that he visited, explored and described with much detail every important coral-reef region of the world, in the Atlantic, Pacific and Indian oceans.

Agassiz's special interest in the coral-island problem was apparently first awakened during his visit to Edinburgh in 1876. I had sketched out a series of papers to be presented to the Royal Society of Edinburgh during that session, and he heard the first of these read, viz., "The Distribution of Volcanic Débris over the Floor of the Ocean, its Character, Source and some of the Products of its Disintegration and Decomposition." He became rather enthusiastic about the results arrived at in the paper. Another of these papers dealt with the distribution of carbonate of lime over the floor of the ocean and with coral-reef formations. One of the most striking results of the *Challenger* expedition was the discovery of enormous numbers of pelagic calcareous algæ, pelagic foraminifera and pelagic mollusca in the surface and sub-surface waters everywhere within tropical and sub-tropical regions, but the dead calcareous shells of these pelagic organisms were not distributed with similar uniformity over the floor of the ocean. In some places they formed pteropod and globigerina oozes, but in the very greatest depths not a trace of these shells could be found in the red clays which covered the bed of the ocean. It was observed that the thinner and more delicate shells disappeared first from the marine deposits with increasing depth, and only the thicker and more compact shells or their fragments reached the greater depths. These conclusions were verified again and again during the cruise of the *Challenger*, and subsequently by Agassiz in his expeditions. Evidently the calcareous shells were removed by the solvent action of sea-water as they fell towards, or shortly after they reached, the bottom of the ocean. In the shallower depths the majority of the shells reached the bottom before being completely dissolved, and there accumulated. The solvent action was also retarded in these lesser depths through the sea-water in direct contact with the deposit becoming saturated, and therefore unable to take up more lime. The explanations thus given to account for the disappearance of carbonate of lime from deep-sea deposits were then applied to the interpretation of the phenomena of coral atolls and barrier-reefs. It was argued that all the characteristic features of atolls and barrier-reefs could be explained by a reference to the biological, mechanical

and chemical processes everywhere going on in the ocean without calling in the extensive subsidences demanded by the theories of Darwin and Dana.

Agassiz almost at once adopted these views, saying, "I never really accepted the theories of Darwin and Dana; it was all too mighty simple. Besides," he added, "this new view is founded on observation and can be verified, and I'll attempt to do it, and will visit coral-reef regions for the purpose."

Darwin, it will be remembered, stated that his whole theory was thought out on the west coast of South America before he had seen a true coral reef.[4] The method of Agassiz was to see every true coral-reef region of the world before he formed any theory.

Darwin's theory of coral reefs may be briefly stated as follows: The corals commence by forming fringing reefs along a shore. The shore commences to subside, but the corals grow directly upwards. In course of time a lagoon-channel is formed between the growing reef and the subsiding shore-line. When this process continues for a sufficient length of time the central island completely disappears beneath the waves, and the lagoon of an atoll occupies ultimately the place of the island. The fringing reef thus develops into the barrier reef, and the barrier reef develops into the atoll.

Agassiz writes in 1909 that the result of his studies on coral reefs has been "to dissent *in toto* from the views of Dana and Darwin regarding the mode of formation of barrier reefs and atolls."

In 1902, after his visit to the Maldives, he wrote to me as follows:

> This will be the end of a most successful expedition, perhaps to me the most interesting visit to a coral-reef group I have made. For certainly I have learned more at the Maldives about atolls than in all my past experience in the Pacific and elsewhere. I should never have forgiven myself had I not seen the Maldives with my own eyes and formed my own opinion of what they mean.—Such a lot of twaddle—it's all wrong what Darwin has said, and the charts ought to have shown him that he was talking nonsense. . . . At any rate I am glad that I always stuck to writing what I saw in each group and explained what I saw as best I could, without trying all the time to have an all-embracing theory. Now, however, I am ready to have my say on coral reefs and to write a connected account of coral reefs based upon what I have seen. It will be a pleasure to me to write such a book and illustrate it properly by charts and photographs. But it will be quite a job with my other work on hand. I hope to live to 100! or rather I don't hope, but ought to! to finish all.

Later, in 1907, he writes: "I have started on my coral-reef book, but it is a job, a good deal more than I expected. If I stay at home I ought to make good progress." Later in the same year he says: "I fancy I shall have all the time I want to write out my popular account of coral reefs. I have made a fair beginning, and hope to keep the material within reasonable bounds and not allow it to run away with me." Four months before his death he wrote: "I have worked hard at my coral-reef book," and only a few days before his death he told me in London that he had really sketched out this book three times, but found it very difficult indeed to deal satisfactorily with the mass of information that had been collected. It was his intention, he stated, to write this book during the present year practically for the fourth and last time, leaving out all criticism of the work of others and stating exactly what he had himself observed and his own views.

When in 1903 he addressed the Royal Society of London on coral reefs, he simply described what he had seen in the various

[4] See "Life and Letters of Charles Darwin," Vol. I., p. 70, London, 1887.

coral-reef regions, and did not enter into any controversial matters. The real point of his address came out in the subsequent discussion, viz., that in all his investigations and voyages he had not seen one single atoll or barrier-reef which could be said to be an illustration of the Darwinian theory of coral reefs. It was evident to a large number of naturalists who had themselves observed in the field that the subsidence theory was no more necessary to account for the characteristic features of atolls and barrier reefs than the elevation theory of Darwin—published about the same time—was necessary to account for the Parallel Roads of Glen Roy in Scotland.[5]

It is difficult to account for the heated controversies which have raged around the coral-reef question. Possibly these would never have taken place had the subsidence theory not been associated with the name of Darwin. Very many of the public did not seem to realize that this theory of coral reefs was the work of Darwin when young and inexperienced, and had nothing whatever to do with the theory of natural selection. When the late Duke of Argyll published his famous article entitled "A Conspiracy of Silence," in the nineteenth century (September, 1887), he gave *Bathybius* and *coral-reef theories* as illustrations, and many people regarded the article as a suggestion that Darwinists and evolutionists were disposed to burke free discussion. This was hotly resented by Huxley and others, while some naturalists seem to have believed they were called upon to defend Darwin's coral-reef theory, although they had never seen or examined a coral-reef. Agassiz kept severely aloof from all these controversies, although he writes that he was much amused by the style of various articles and controversies. In one letter to me (March, 1888) he writes: "I am glad to see by last *Nature* that you are taking a hand in the coral discussion now that it has reached *hard bottom* and no longer deals with imaginary quantities, impossible algebra and metaphysical squibs."

All scientific men must regret that Agassiz was not spared to publish the long-expected summary of his coral-reef work, and to learn that he has not left behind any manuscript suitable for publication giving a connected statement of his views. Such a work from his pen would doubtless have been a splendid edifice erected on the magnificent foundation of observation laid with so much expense, trouble and care in the elaborate memoirs on the coral-reef regions he had visited in all parts of the world.

Throughout all these coral-reef investigations I have been in substantial agreement with Agassiz's views. In these circumstances I need make no apology for giving a short statement of the conclusions at which, I think, Agassiz had arrived as a result of his coral-reef investigations.

Agassiz claimed, I believe, to have shown that existing atolls and barrier reefs in no way indicate, even approximately, the former position of the shore lines around islands or along coasts now deeply submerged beneath the ocean.

The submerged banks from which atolls and barrier reefs now arise have been formed—that is, they have been built up or leveled down—in a great variety of ways, and at very different times. Each coral-reef region must in this regard be studied by itself, account being taken of

[5] See "Observations on the Parallel Roads of Glen Roy, and of other parts of Lochaber in Scotland, with an attempt to prove that they are of marine origin," *Phil. Trans.*, 1839, p. 39; *Edin. New Phil. Journ.*, Vol. XXVII., p. 395, 1839.

the surrounding physical and geological conditions.

The reefs themselves have been very largely—in some instances, predominantly—made up of lime-secreting organisms other than the so-called reef-building corals, such as calcareous algæ, foraminifera and corals other than true reef builders, many of which have a wide depth range.

The characteristic features of coral-reefs—the central shallow lagoon and the surrounding rim of living coral with deep water outside—are mainly to be explained by biological, chemical and mechanical activities continuously in operation at the present time, there being vigorous growth of all lime-secreting organisms wherever the conditions of life are most favorable, and less vigorous growth and even death of these organisms where the conditions are unfavorable. A detailed study of the favorable and unfavorable conditions for different species in an existing atoll seemed to Agassiz a great desideratum at the present time and I am delighted to learn that this is now being undertaken by American naturalists under the auspices of the Carnegie Institute.

In small atolls, where the surrounding reef is very extensive relatively to the enclosed lagoon, the lagoon tends to become filled up by the accumulation of coral sand, the deposition of carbonate of lime by the living organisms of the atoll being in excess of that removed in solution and by mechanical means; where the atoll is large, and the encircling reef is—relatively to the size of the lagoon—small, then the lime removed from the lagoon by solution and currents is greater than that deposited by living organisms; hence the lagoon becomes deeper and wider. The lagoon of Diego Garcia appeared to have increased considerably in area in this way between 1837 and 1885.

It is undoubtedly true that many coral-reef regions have been recently elevated. The circular atoll and barrier reef can not be accepted as evidence of subsidence; the characteristic features of coral reefs would be very similar in a stationary, in a slowly sinking or slowly rising area, although each would show secondary modifications. It matters not whether the change of sea-level be due to crustal movement, to attraction of elevated continental land, or to the accumulation or the melting of polar ice-masses.

When coral plantations rise from a submerged bank, the corals and other lime-secreting organisms situated towards the seaward edge would from the first have the advantage; they would hence reach the surface, before the central portions, where the corals would be in a position more or less unfavorable for vigorous growth. A shallow lagoon would thus be formed, which might subsequently be cleared by solution, and mechanical action of many of its living coral plantations.

The coral atoll, on reaching the surface would, he admitted, in very many cases advance seawards on a talus of its own débris, expanding like a fairy ring, and it seemed to him more than probable that the boring at Funafuti atoll was driven down into such a talus, with an underlying Tertiary base.

The red earth which is found on coral islands and supplies the food for plant life, is chiefly derived from the disintegration and decomposition of floating pumice, which is frequently thrown up by the waves on the reefs.

These results of Agassiz depend on a far greater number of original observations, in widely scattered areas, than have been made by all the other authorities on coral reefs put together.

When we attempt to survey the life-work of Alexander Agassiz, we are aston-

ished at its amount, variety and quality. His activities in any one direction would have been an excellent record for any one man, but he was many sided. He was largely engaged in commercial undertakings and directed a great business during the whole latter half of his life; he carried on detailed researches and published splendid memoirs on the group of echinoderms—a subject on which he was regarded as the leading authority. In his deep-sea researches he added greatly to the world's knowledge of the great oceans, and inspired the investigations of a very large number of zoological and other specialists. In his study of coral-reefs he traveled more extensively than any man of his time—many thousands of miles—with one special object in view—to see with his own eyes the varied forms which these gigantic and beautiful natural structures assume under different conditions. We must likewise take into account his work in the laboratory and in the study, where the reports on his many voyages, cruises, travels and collections had to be prepared for publication. Again one must recall the services he has rendered to his *alma mater*—Harvard University—in his general assistance in administration, his special care of its museums, his donations for extensions in many directions, and lastly his altogether grand series of publications from the Museum of Comparative Zoology.[6] His great desire was to add to the sum of natural knowledge by his own work and by the impulse he could give to others imbued with a similar spirit and desire. He worked and struggled continuously and heroically with that end in view, and with those who are now engaged in working up his results and collections in all civilized countries he is still a living force, and will be so for many years to come, for he has arranged for the publication of all the results of these researches. I used to meet him nearly every year either in Europe or in America, when we spent a few days together discussing almost all oceanic problems. I am conscious of his effect on my life and all my scientific work. As an example of the influence he exerted we have only to look at the introduction to the three splendid volumes recently published on the medusæ of the world by Alfred Goldsborough Mayer, where the initiation and encouragement of a generous master and friend are gracefully acknowledged. Many instances might be cited to show how well and judiciously he applied his wealth to set agoing work which he considered worth doing, not only in his own time but also in the future. The large number of decorations and honors which were conferred on Alexander Agassiz by governments and universities and by learned societies in all parts of the world show abundantly how highly his scientific labors were appreciated by his contemporaries.

It has been truly said that man does not live by bread alone. History is crowded with instances illustrating the fact that men have cast off this mortal coil as so much worthless dross when impelled by the demands of some spiritual truth. Other men have endured the greatest hardships and privations in their endeavors to create the beautiful in form, in sound or in color. As it has been with the religious and artistic spirit in the past, so is it with the modern scientific spirit. The desire to find out the secrets of nature impels men to trudge over Arctic and Antarctic ice-fields with the satisfaction of all bodily requirements reduced to a minimum and burdened with a load of scientific instruments. Other men expose their bodies to the at-

[6] Fifty-two volumes of the *Bulletin* and thirty-two volumes of *Memoirs*.

tacks of pestilential microbes for the advance of knowledge and the betterment of man's estate, while Alexander Agassiz rises with difficulty, when overwhelmed with sickness, and has his mattress laid on the deck of the tossing steamer in order that he may the better record the message which the dredge or trawl has brought to light from the dark abysses of the Atlantic or Pacific Ocean. In such men the body has truly become merely the vehicle of the soul.

It has been said that Alexander Agassiz was a sad and reserved man. It must be admitted that during the latter part of his life he was not so moved by joyous impulses as in his earlier years. Those who knew him well did not find him reserved, and they can testify to the great pleasure he derived from a new discovery or a new view of the interrelations among natural phenomena.

It has also been said that he did not interest himself in the deeper philosophical aspects of the researches in which he was engaged. This I believe to be a mistake. He professed never to engage in discussions except where it was possible to verify one's conclusions by an appeal to observation or experiment. Although he did not publish papers dealing directly with philosophical subjects, still he was keenly interested in all evolutionary problems. He used to say that Darwin had probably explained the survival but not the arrival of species, and he looked forward to a great increase of knowledge from experiments in Mendelism. He believed that the mutation theory had received remarkable confirmation by experiments carried on in recent years. He believed that the doctrines of heredity, which had been so successfully applied to the improvement of domestic plants and animals, would, in the not very distant future, be in like manner applied for the elevation of the human species, the most important of all domestic organisms. He felt convinced that the modern theories as to electrons, the disruption of atoms, and as to energy configurations in the ether being the sole ultimate phenomenal basis of matter would in time profoundly affect the philosophical outlook of many naturalists and their mental attitude generally towards materialism and the riddles of the universe. The study of the world of physical and mental phenomena, he would say, was sufficient for this life. The deeper and more earnestly these were investigated, the brighter and more definite would become the glimpses of that eternal something lying behind all manifestations, which in the meantime he was content to reverence. His religious feelings seemed to be best expressed as a yearning after a higher and better life, which he held would become more attainable and more pronounced as mankind advanced in scientific knowledge. Like all great men he was

> A dreamer of the common dreams,
> A fisher in familiar streams:
> He chased the transitory gleams
> That all pursue,
> But on his lips the eternal themes
> Again were new.

Great he unquestionably was. Great in his power for work, great in his conception of duty, great in his desire to add to natural knowledge, great in the height of his love, great in the depth of his sorrow, great in his elevated personality, great in his admiration for his university, great in his patriotism, great in his ideas as to the destiny of our race, great in his influence for good, like the genial and vivifying rain from heaven. Like all of us he doubtless had faults, both hereditary and acquired. We know that

His life was gentle, and the elements
So mix'd in him, that Nature might stand up
And say to all the world, "This was a man!"

When his near relatives and dear friends affectionately laid his mortal remains beside those of his beloved wife last March in the Forest Hills Cemetery, well might they ask—

What hallows ground where heroes sleep?
'Tis not the sculptured piles you heap.
But strew his ashes to the wind,
Whose sword or pen has served mankind.
And is he dead, whose glorious mind
Lifts mine on high?
To live in hearts we leave behind
Is not to die.

JOHN MURRAY

CHARLES M. SCAMMON

CAPTAIN CHARLES M. SCAMMON, U. S. R. M., retired, senior officer of the service, died at his home, in East Oakland, Cal., May 2, in his eighty-sixth year. His death followed in less than twenty-four hours after that of his wife to whom he had been united for sixty-five years.

Captain Scammon was a native of Maine and came to the west coast in 1853, and for a time was engaged in the pursuit of whaling. He was the discoverer of the large lagoon on the west coast of Lower California in latitude 27° 50′, which has since borne his name. In 1861 he joined the revenue service with which he was connected until his death. He was detailed by the government to assist in the explorations of the Overland Telegraph Expedition in 1865, and commanded the flagship of their fleet for three years. To his intelligent and kindly cooperation the scientific corps of that expedition owed much of their success. Captain Scammon early became interested in the natural history of the marine mammals of the Pacific coast, and in those days before the invention of photographic dry plates, spared no trouble in gathering measurements, drawings and other data bearing on the cetacea. In 1874 these investigations were summed up in his finely illustrated quarto volume on the "Marine Mammals of the Northwestern Coast of North America," which forms the most important contribution to the life history of these animals ever published, and will remain a worthy monument to his memory.

WM. H. DALL

SCIENTIFIC NOTES AND NEWS

PROFESSOR E. C. PICKERING, director of the Harvard College Observatory, has been created knight of the Prussian order Pour le mérite. Simon Newcomb and Alexander Agassiz are the only other American men of science on whom this honor has been conferred.

DR. THEODORE WILLIAM RICHARDS, professor of chemistry at Harvard, who is going to England at the invitation of the Chemical Society to deliver the Faraday lecture, will be given the honorary degree of D.Sc. by the University of Manchester on July 8.

DR. FREDERICK W. TRUE, who has held the position of head curator of the department of biology in the U. S. National Museum since 1897, has been appointed assistant secretary of the Smithsonian Institution in charge of the library and exchanges.

LORD CURZON, of Kedleston, has been elected president of the Royal Geographical Society in succession to Major Leonard Darwin.

THE Hanbury medal of the London Pharmaceutical Society for 1911 has been awarded to M. Jean Eugène Léger, chief pharmacist to the Hôpital St. Louis, Paris.

THE Royal Academy of Sciences of Berlin has elected Dr. James George Frazer, fellow of Trinity College, Cambridge, and professor of social anthropology at Liverpool University, a member of the Philosophical-Historical Section.

THE American Philosophical Society at its recent meeting, elected the following residents of the United States to membership: George A. Barton, professor of Semitic languages, Bryn Mawr College; Bertram Borden Boltwood, professor of radio-chemistry, Yale Uni-

versity; Lewis Boss, director of the Dudley Observatory, Albany, N. Y.; John Mason Clarke, state geologist and paleontologist and director of the State Museum and Science Division of the Educational Department, Albany, N. Y.; W. M. L. Coplin, professor of pathology and bacteriology, Jefferson Medical College, Philadelphia; John Dewey, professor of philosophy, Columbia University; L. O. Howard, chief of the Division of Entomology, U. S. Department of Agriculture; Joseph P. Iddings, Washington, D. C.; Alba B. Johnson, Baldwin Locomotive Works, Philadelphia, Pa.; A. A. Noyes, professor of physical chemistry, Massachusetts Institute of Technology; G. H. Parker, professor of zoology, Harvard University; A. Lawrence Rotch, director of the Blue Hill Meteorological Observatory and professor of meteorology, Harvard University; Dr. Leo S. Rowe, Philadelphia, Pa.; Dr. William T. Sedgwick, professor of biology at the Massachusetts Institute of Technology and biologist of the Massachusetts State Board of Health, and Dr. Augustus Trowbridge, professor of physics at Princeton University. The following foreign residents were elected: Dr. Svante Arrhenius, director of the Nobel Institute, Stockholm; J. B. E. Bornet, Paris; Sir John Murray, Edinburgh.

Professor Ugo Mondella, director of the geophysical observatory at Leghorn, has been appointed director of the Observatorio Regional do Rio Grande do Sul, Porto Alegre, Brazil.

The delegates of the University Museum, Oxford, have appointed Dr. H. L. Bowman, fellow of Magdalen College and Waynflete professor of mineralogy, to be their secretary, in place of Mr. H. Balfour, curator of the Pitt-Rivers Museum, who resigns that office next month.

Mr. J. Clyde Marquis, instructor in agricultural journalism and agricultural editor at the University of Wisconsin, has accepted the position of agricultural editor of the *Country Gentleman*, recently purchased by the Curtis Publishing Company, Philadelphia. Mr. John Y. Beaty, associate editor of *Farm and Home* and the *Orange Judd Farmer*, has been appointed instructor in agricultural journalism and agricultural editor in place of Mr. Marquis.

The Academy of Natural Sciences of Philadelphia has appointed the following delegates: Professor Carlo Emery to the fifty-year jubilee of Professor Giovanni Capellini, Professor G. O. Sars to the centennial anniversary of the founding of the University of Christiania and Mr. Henry G. Bryant to the tenth International Geographical Congress.

Professor W. B. Herms, of the University of California, is on his way to Europe where, during the summer, he will visit the principal parasitological laboratories of England, France, Germany and Italy. He will represent the University of California as authorized delegate to the International Hygiene Exhibit at Dresden.

Mr. William Bateson, F.R.S., has been appointed Herbert Spencer Lecturer at Oxford for 1911.

Dr. William T. Sedgwick, professor of biology in the Massachusetts Institute of Technology, will give the commencement address at the Worcester Polytechnic Institute on "Science and the State."

Professor W. J. V. Osterhout addressed the Biological Society of Smith College, May 18, on "Some Aspects of the Action of Mineral Salts on Plants."

Dr. G. B. D. de Nancrede, of the medical department of the University of Michigan, will give the commencement address before the Medical College of the University of Nebraska, at Omaha, May 18. His subject will be "False and True Professional Success."

Professor H. H. Turner delivered the Halley Lecture at Oxford on May 22, his subject being "The Movements of the Stars."

Professor B. G. Wilder was born in Boston, not (as stated in our last issue) in Brookline, where his boyhood was passed.

WE learn from *Nature* that the committee of the Robert Koch memorial endowment for the encouragement of research in the subject of tuberculosis has decided to give grants to Professor Schieck and Dr. Krusius for investigations on tuberculosis of the eyes, to Dr. Weinberg for statistical inquiries relative to tuberculosis and to Professor Gaffky for the continuation of his researches. Since the year 1908 the sum of £3,600 has been expended by the committee in scientific work.

A STATUE to the memory of Priestley is to be erected in the market-place of Birstall, the town of his birth.

It is proposed to erect a monument to Richard Lander at Forcados on the lower Niger, of which he was the discoverer.

DR. STANFORD EMERSON CHAILLÉ, for forty-one years professor of physiology and pathological anatomy in the medical department of Tulane University, retiring as professor emeritus in 1908, eminent for his contributions to hygiene and public health, died on May 28 in his eighty-first year.

PROFESSOR SOLOMON WOOLF, professor emeritus of drawing and descriptive geometry in the College of the City of New York, died on May 27. He was born in Mobile, Ala., seventy years ago, and was graduated from the College of the City of New York in 1859. He remained there as instructor and professor for the rest of his life, being made professor emeritus in 1901.

PROFESSOR KEINOSUKE OTAKI, professor of ichthyology and fishery matters in the Agricultural College at Sapporo, Japan, died on April 26, 1911, his death being the result of an injury in a railway accident three years before, from which he never recovered. He was the first Japanese student to enter Stanford University, from which he graduated in 1894. He devoted himself to research on the fisheries, was for a time an assistant on the United States Fish Commission, and is the author of several valuable papers on the fishes and fisheries of Japan. For some ten years he was professor of English in the Imperial Military Academy in Tokyo. He was one of the most active and efficient of the Japanese naturalists.

DR. N. STORY MASKELYNE, from 1856 to 1895 professor of mineralogy at Oxford, died on May 27, in his eighty-eighth year.

THE fifth International Philosophical Congress will hold its meeting in the buildings of the University of London in the spring of 1915.

THE Otho S. A. Sprague Memorial Institute was organized in January, 1911. It is a memorial to the late Otho S. A. Sprague, who for many years was a resident of Chicago and who died about two years ago in Pasadena, California. Mr. Sprague designated his brother, A. A. Sprague, as the chief instrument through whom funds left by will should be expended. The institute was organized by Mr. A. A. Sprague with the following named gentlemen as members of the corporation and the first board of directors: Martin A. Ryerson, Charles L. Hutchison, A. C. Bartlett, Byron L. Smith, Albert A. Sprague, 2d, Dr. Frank Billings, John P. Wilson and Albert A. Sprague. For the present the directors have decided upon medical research as the chief object for which the income of the memorial funds shall be expended and have selected Dr. H. Gideon Wells, associate professor of pathology in the University of Chicago and Rush Medical College, to direct research in medical problems. The work will be done in cooperation with existing institutions, viz., the University of Chicago, Rush Medical College, the Presbyterian Hospital and the Children's Memorial Hospital of Chicago. The institute will command a definite number of beds in the Presbyterian Hospital for the study of any diseases under investigation. An advisory council has been appointed consisting of Drs. Frank Billings, James B. Herrick, Joseph L. Miller and Professors E. R. Le Count, Ludvig Hektoen, E. O. Jordan and Julius Stieglitz.

THE Surgeon-General of the army announces that preliminary examinations for

the appointment of first lieutenants in the Army Medical Corps will be held on July 10, 1911, and September 5, 1911. Full information concerning these examinations can be procured upon application to the "Surgeon-General, U. S. Army, Washington, D. C." The essential requirements to securing an invitation are that the applicant shall be a citizen of the United States, shall be between 22 and 30 years of age, a graduate of a medical school legally authorized to confer the degree of doctor of medicine, shall be of good moral character and habits, and shall have had at least one year's hospital training, after graduation. The examinations will be held concurrently throughout the country at points where boards can be convened. Due consideration will be given to localities from which applications are received, in order to lessen the traveling expenses of applicants as much as possible. The examination in subjects of general education (mathematics, geography, history, general literature and Latin) may be omitted in the case of applicants holding diplomas from reputable literary or scientific colleges, normal schools or high schools, or graduates of medical schools which require an entrance examination satisfactory to the faculty of the Army Medical School. In order to perfect all necessary arrangements for the examination, applications must be complete and in possession of the Adjutant General at least three weeks before the date of examination. Early attention is therefore enjoined upon all intending applicants. There are at present sixty-one vacancies in the Medical Corps of the Army.

A BIOLOGICAL party from the University of Nebraska has been formed for the purpose of carrying on ecological work in central and western Nebraska during the coming summer. The party will spend all the time between June 15 and September 15 in the field, dividing the period between three selected stations, where sets of recording apparatus will be installed, and from these making excursions to other points. The party includes Dr. Robt. H. Wolcott and Mr. Frank H. Shoemaker, of the department of zoology, and Professor Raymond J. Pool, of the department of botany, from the university, and Professor Cyrus V. Williams, professor of botany in Nebraska Wesleyan University. In addition to those named, who will devote the whole summer to the work, other persons specializing in certain lines will be with the party for shorter periods at different times during the summer. The particular problems which the party will deal with are concerned with the ecology of the sandhill region of Nebraska and the biological conditions in the Cherry County lakes.

SPEAKING in the House of Commons on the budget proposals, Mr. Balfour, as quoted in *Nature*, asked the chancellor of the exchequer to exercise caution in carrying out his scheme for the expenditure of large sums of money on building consumption sanatoria. In the public mind, he said, there had perhaps been an exaggerated enthusiasm for this method of dealing with tuberculosis. There was an idea that this open-air treatment had produced such marvelous results that through it alone tuberculosis could be, if not exterminated, at all events diminished to such an extent that it might be reduced to one of the rare zymotic diseases. He was not sure that the most recent investigations bore out that view. There were very able investigators who took the view, after examining the actual results in England and in Germany, that so many complete cures must not be expected as was at one time hoped for. He took a sanguine view as to the treatment of tuberculosis, for he believed that science had made great strides and was still destined to make great strides, but when they came to such large sums as those mentioned by the chancellor of the exchequer, it was possible to waste money on permanent buildings which might be better devoted to scientific investigation into the cause of the disease. They must not assume that all that they had to do was to spend money on these sanatoria in order to effect a cure. What was important was that medical science had made great progress, and we re-

quired further investigation and perpetual study as to how these people were to be treated when in the sanatoria. One of the greatest benefits, perhaps, of establishing these sanatoria would be in giving expert medical authorities the opportunity of carrying on investigations which would enable them in the future to deal with this disease in a way they were not able to do at present. In reply, Mr. Lloyd George said he agreed that the important thing was to encourage scientific investigation, so as to arrive at the best methods of cure. That was provided for in his bill. There would be set aside a special fund for the purposes of scientific research. The government would make use of and assist existing sanatoria, those which had been maintained by voluntary contributions, and even those which were built by private enterprise.

UNIVERSITY AND EDUCATIONAL NEWS

MR. MORTON P. PLANT has offered to give an endowment of $1,000,000 for the woman's college which is to be established at New London, Conn. It is a condition that the name shall be changed to the Connecticut College for Women.

THE General Educational Board has made public a list of its latest appropriations for colleges and schools, amounting in all to $634,000. All the gifts to colleges are conditional and are applied to endowment only. Other gifts may be applied to current expenses. The list follows:

College	Appropriation	To Be Raised
Converse, Spartansburg, S. C.	$50,000	$100,000
Drury, Springfield, Mo.	75,000	325,000
Franklin, Franklin, Ind.	75,000	325,000
Franklin and Marshall, Lancaster, Pa.	50,000	225,000
Huron, Huron, S. D.	100,000	100,000
Pennsylvania, Gettysburg, Pa.	50,000	150,000
Totals	$400,000	$1,225,000

Appropriations aggregating $68,000 went to the education of southern negroes, $130,000 is set aside for demonstration work in agriculture, also in southern states, under the supervision of Bradford Knapp, and $36,000 for professors of secondary education in state universities of the south.

BROWN UNIVERSITY receives a bequest of $85,000 from Oliver Henry Arnold, M.D., of Providence.

THE Boston Edison Company will give the Massachusetts Institute of Technology $3,000 for a period of years for the purpose of electrical research involving a thorough investigation of the use of electricity in vehicles employed in trucking or delivery.

WESLEYAN UNIVERSITY has purchased ground from the Russell estate as a site for a new observatory, which will be erected from the proceeds of a fund given in 1903 by Mr. Joseph Van Vleck. This gift has been increased by others, and now approaches $60,000.

SIR FELIX SEMON, M.D., has transferred to the University of London, for the foundation of a lectureship in laryngology, a sum of money amounting to £1,040 presented to him by the British laryngologists on his retirement from practise.

THE Connecticut Agricultural College will conduct from July 5 to 28 a summer school of nature study, agriculture and agricultural pedagogy, of which Professor A. F. Blakeslee is the director.

PROFESSOR GEORGE F. KAY, who has been for four years professor of petrology and economic geology in the University of Iowa, has been elected head of the department of geology to succeed Dr. Samuel Calvin, who died on April 17. Professor Kay has also been chosen by the Geological Board to succeed Professor Calvin as director of the State Geological Survey.

DR. CHARLES LINCOLN EDWARDS has been appointed assistant professor of biology and assistant director of the marine biological station in the University of Southern California.

LIEUT. COL. WIRT ROBINSON, Coast Artillery, has been nominated by the president to be professor of chemistry at West Point, to take

effect on October 3, to succeed Col. Samuel E. Tillman, who has been the head of the department of chemistry, mineralogy and geology since December 21, 1880, and retires for age on October 2.

The following changes take place in the department of philosophy in the University of Michigan: Professor Alfred H. Lloyd has leave of absence for the year 1911–12. During his absence Charles Milton Perry, Ph.D. (Mich.), joins the staff as instructor in philosophy. Dr. John F. Shepard, instructor in psychology, has been advanced to an assistant professorship. An additional instructorship in psychology has been created. It will be filled by Henry Foster Adams, Ph.D. (Chicago). Harry Wolven Crane, A.B. (Mich.), at present assistant in psychology, has been elected to the George S. Morris memorial fellowship for the year 1911–12.

The following appointments have been made at McGill University: Dr. N. H. Alcock, to the chair of physiology; Associate Professor Ernest Brown, to be professor of applied mechanics and hydraulics; H. Barton, to be professor of animal husbandry at Macdonald College. The following promotions have been made in the faculty of applied science: Mr. Batho, assistant professor of mechanics; Mr. Graham, assistant professor of mineralogy; G. M. G. Johnston, assistant professor of chemistry; H. M. Lamb, assistant professor of civil engineering; S. W. Werner, lecturer in assaying.

DISCUSSION AND CORRESPONDENCE

ACADEMIC AND INDUSTRIAL EFFICIENCY

There is one way in which the efficiency of industrial concerns and of educational institutions can be compared effectively, viz., in the administration of the finances.

In the following paragraphs, a number of representative educational institutions are compared to the railways of the United States as to the ratio of compensation of labor to operating expenses.

According to "Railway Statistics of the U. S. of America for the year ending June 30, 1909,"[1] the ratio of compensation of labor to operating expenses is 62.06 per cent., which, if we except one year, is the highest ratio in eleven years past.

Moreover, we might state that the usual rule for industries in general is that about 65 per cent. of operating expenses goes to labor.

In the case of the railway statistics quoted above the salaries of administrative officers, "clerks" and "all other employees" are included, as shown on page 36, and as expressly stated to the writer of this article by the compiler of the statistics.

Thus in the following statistics on educational institutions, salaries of administrative officers and all other employees, are included along with the "productive" laborers, in this case, the teachers.

And, moreover, we must remember here that while a railway administrative officer is *only* an administrator and in no wise "productive," the administrative officer of the university or college is often, and indeed, in colleges prevalently, also a teacher and thus is "productive."

Moreover, the highest salaried officers in educational institutions are in all cases "productive'' whether they do actual class-room teaching or not. Presidents and deans in all colleges and universities are productive, in that they lecture a good deal, and hold numberless consultations with students which are as valuable, or more so, to the latter as are the consultations with the professors.

But the institution which pays the most to "productive" labor is the most efficient.

The following schools were selected simply because they are typical of certain kinds of schools and not because they show high efficiency in the matter under discussion. Indeed they are not higher than the average, as far as I know. Other institutions which were investigated, and which might be quoted, show practically the same ratio as those here quoted.

A number of schools showing a low ratio of

[1] Slason Thompson, Bureau of Railway News and Statistics, Chicago, 1910.

compensation of labor to operating expenses might be quoted, but that does not necessarily say anything against the educational efficiency of those schools. The teaching staff may indeed be highly efficient. It simply indicates that too much is being paid for non-essentials as over against teaching, which latter we must consider the main business of the college.

Again it must be borne in mind that in every college in the land there is included in the operating expense a considerable per cent. of money which goes to fellowships, scholarships and other "charitable" purposes, as, for example: subsidizing boarding-clubs, college papers, etc. If this money were not thus devoted to "charity" it might be spent for additional productive labor.[2]

Thus the seven institutions quoted show a ratio of 66.5+ per cent. compensation of labor to operating expense while the railroads show a ratio of only 62.06 per cent.

	Year Ending	Paid to Labor	Operating Expenses	Per Cent.
Throop Polytechnic Institute	Sept. 14, 1909	$ 50,000.00	$ 66,150.16	75.6+
Princeton University	July 31, 1910	462,508.42	701,679.25	65.9+
Baker University	July 15, 1910	43,801.67	64,637.61	67.7+
University of Kansas	June 30, 1910	290,788.55	429,655.93	67.6+
University of Okla.	June 30, 1910	93,599.81	125,659.08	74.4+
Howard University (federal institution)	June 30, 1910	55,450.00	119,574.30	46.3+
Marietta College	May 31, 1910	27,405.45	40,375.67	68.1+
			Average	66.5+

Moreover, less of the labor paid out of college funds is non-productive than in the case of the railroads.

And, finally, operating expense in the case of colleges includes a considerable per cent. of moneys which are devoted to "charity" by which the public profits.

C. H. HANDSCHIN

[2] In the University of Chicago 7.6 per cent. of operating expenses goes to fellowships and scholarships alone. A majority of the larger institutions will show a similar per cent.

THE DIRECTOR VERSUS NEWTON

IN this case the following conversation reported by Professor Maclaurin in SCIENCE, XXXIII., 103, January, 1911, has just come to my notice:

Supt. Your theory of gravitation is hanging fire unduly. The director insists on a finished report, filed in his office by 9 A.M. Monday next; summarized on one page; type-written, and the main points underlined. Also a careful estimate of the cost of the research per student-hour.

Newton. But there is one difficulty that has been puzzling me for fourteen years, and I am not quite . . .

Supt. (with snap and vigor). Guess you had better overcome that difficulty by Monday morning or quit.

I have heard since that the conversation was continued as follows, and I wonder if the director was not right:

Newton. I shall continue to use my own judgment about the disposal of my time.

Supt. Yes, but no scientific man should go fourteen years, or even seven, without publishing results. Fourteen years ago you ranked among the leading thousand scientific men, but seven years ago your name was dropped, and this year it was not restored. A city that is set on a hill can not be hid.

Newton. Still I think I am right.

Supt. But the director thinks that, as long as you are accepting pay as a leading scientific man, you should *publish* enough results to keep up your reputation.

CHARLES ROBERTSON

CARLINVILLE, ILL.,
May 1, 1911

AN ENGLISH COURSE FOR ENGINEERING STUDENTS

TO THE EDITOR OF SCIENCE: I am not writing at present to discuss that much-discussed topic, the teaching of practical composition to engineering students, but to explain the first semester work in a course for freshman engineers given at the University of Minnesota, a two-hour course in English which goes hand in hand with a two-hour course in the more practical composition. Two authors are studied, Arnold and Huxley, the former in Gates's "Selections from Matthew Arnold," and the latter in Snell's "Autobiography and Selected Essays by Thomas Henry Huxley" in the Riverside Literature Series.

To the boy who enters the engineering college fresh from high school, the reading of Arnold's "Sweetness and Light," "Hebraism and Hellenism," etc., is both stimulating and broadening. It forces the freshman to think, to sum up his own ideas concerning his relation to life and the world about him; and perhaps, before he realizes it, his outlook on life has widened. Arnold teaches him to value himself for what he is, to understand what ideal perfection is, to attempt, specialist though he be, to prepare himself for a well-balanced life. The results of Arnold's teaching I have found in impromptu paragraphs on "My Aim in Life," written in the composition class. Here, back of an occasional obvious effort to write what might please the instructor, I have seen evidence of a sincere desire on the student's part to be not only a perfect engineer, but a well-rounded man as well.

The transition to Huxley is made through his controversy with Arnold over the means of getting a cultural education. In Percival and Jelliffe's "Specimens of Exposition and Argument" which the men use in their composition course, is Huxley's address at the opening of Sir Josiah Mason's Scientific College in Birmingham. Arnold's reply is in Gates's "Selections." This controversy gives the freshman a good idea of different views of education, especially of scientific education, and paves the way for Huxley's talks on "A Liberal Education," "Principal Subjects of Education" and "On Improving Natural Knowledge."

The subject-matter and structure of Huxley's addresses appeal to the freshman engineer. This part of the course fits in particularly well with the exposition work in composition. The student learns how to fit his material to his audience, how to outline clearly, how to say things most concisely and in the strongest way; and the fact which the autobiography gives us, that Huxley at first detested writing and speaking, encourages the freshman to emulate Huxley's example and master his mother tongue, that he, too, may best put his ideas before others. As to the subject-matter, what is better fitted to interest the scientific student than "On a Piece of Chalk," "Coral and Coral Reefs" or "The Physical Basis of Life"? Such essays open up for him the great facts of nature which have come in with the "new knowledge."

The fact that this course, joined to the course in practical composition (which is another story), is required of all engineering freshmen and that it is the only course of its kind which they will ever get in college, makes the question of proper subject-matter of vital importance. I should welcome criticism and suggestions.

Charles Washburn Nichols
The University of Minnesota,
December 27, 1910

A KINETIC THEORY OF GRAVITATION

To the Editor of Science: In reading the article entitled "A Kinetic Theory of Gravitation," which was published by Dr. Brush in Science for March 10, I was at once struck with what seemed to me a fallacy in an illustration given early in the discussion. Perhaps the point at issue has been sufficiently discussed by Dr. Kent in Science for April 21; but since it presented itself to me somewhat differently it may not be out of place to give my line of reasoning.

I refer to the consideration by Dr. Brush of the case of the transportation of a one-pound mass from the surface of the earth to a point of equilibrium between the earth and the moon, at which point there would be no tendency for the body to move either toward the earth or toward the moon. As I understand the argument of Dr. Brush he assumes that in this case there is an apparent disappearance of energy; that there is no gain in the potential energy of the system caused by raising this body from the surface of the earth to the position of equilibrium and that there is, so to speak, nothing to show for the work done in so raising it.

The point that Dr. Brush seems to have overlooked is that attraction between two bodies is mutual. If the pound mass in the position of equilibrium is attracted by earth

and moon it in turn attracts both earth and moon. The tendency for the earth and moon to approach each other is greater than before the pound mass was raised from the surface of the earth; the potential energy of the system is increased by an amount equal to the energy expended in raising it and there is no more a disappearance of energy to be accounted for than in the simpler case where a mass subject to no attraction but the earth's is raised above the earth.

E. S. MANSON, JR.

COLUMBUS, OHIO,
April 29, 1911

SCIENTIFIC BOOKS

Œdema. A Study of the Physiology and Pathology of Water Absorption by the Living Organism. By MARTIN FISCHER, M.D. Pp. 209. New York, John Wiley and Sons. 1910.

A trenchant alternative to current and generally accepted ideas of the distribution of water in the organism is presented by Fischer in this essay. The familiar reference to filtration, diffusion and osmosis as explanatory factors is notably absent and, instead, the part played by the colloids in the cells and body fluids is emphasized. That some colloids, such as gelatine, for example, are able to take up water and thus enormously to increase their volume is common experience. Such "hydrophilic" colloids Fischer has investigated with reference to the conditions which cause them to take in water or to give it forth. The degree of swelling of the colloid depends on its nature and also on the character of the solution in which it is placed. Thus both gelatine and fibrin swell more in alkaline or acid solutions than in water, both have the amount of swelling in acid or alkaline solutions reduced by the presence of electrolytes, and in both the addition of non-electrolytes fails to exert the checking effect produced by electrolytes. By extensive experiments Fischer has demonstrated that the body tissues, represented by muscle and the eyes, when immersed in water, or in acid and alkaline solutions, or in combinations of acid and alkaline solutions with various electrolytes, behave in a manner quite analogous to gelatine and fibrin.

On the basis of these experiments the suggestion is offered that œdema is induced whenever, in the presence of an adequate supply of water, the affinity of the colloids of the tissues for water is increased above what we call normal. Particularly by the accumulation of acids in the tissues is the affinity for water increased. Thereupon Fischer proceeds to show that states in which œdema develops are accompanied by an abnormal production of acid, that under such circumstances œdema can be reduced by the same agencies (electrolytes) which decrease the affinity of hydrophilic colloids for water, but remains unaffected by non-electrolytes, and that experimental production of acids in tissues results in the development of œdema.

The argument thus devised for the explanation of œdema in general is applied to the peculiar phenomena of œdema in special organs, and is then extended to other biological phenomena in which the transfer of water plays an important rôle, as in hæmolysis, growth and urinary secretion.

The experimental procedures on which the conception described in this volume is founded are of the utmost simplicity, and can be readily tested by any one. Fischer's application of these simple tests to conditions in the body is made with much ingenuity and in many instances with compelling conviction. To what extent the process can be used to explain certain results of experimental procedures which cause increased production of lymph, or which vary the amount of urine secretion, remains to be seen. Certainly the conception is highly suggestive, and well worth putting to further test.

The subject is expounded by Fischer with clearness, with enthusiasm, and with evident assurance of the adequacy of the theory to meet the demands that can be put upon it. The essay was awarded the Nathan Lewis Hatfield Prize by the College of Physicians of Philadelphia in 1909.

W. B. CANNON

Introductory Notes on Quantitative Chemical Analysis. By Charles William Foulk, Professor of Analytical Chemistry in the Ohio State University. Second edition, revised and enlarged. Columbus, Ohio. 1910.

This is a very detailed but simple manual for college work in quantitative analysis. 130 out of 239 pages are given to general principles and methods. Detailed description of 14 practical analyses occupies the remainder of the volume.

E. R.

Qualitative Chemical Analysis, Organic and Inorganic. By F. Mollwo Perkin, Ph.D., Late Head of the Chemistry Department, Borough Polytechnic Institute, London. Third edition. New York, Longmans, Green, & Co.

This is an excellent manual of systematic, qualitative, inorganic analysis followed by a manual of qualitative organic analysis; the latter necessarily consists chiefly of special tests. It will doubtless be found useful.

E. R.

Publications of the Astronomical and Astrophysical Society of America. Vol. 1, pp. xxvii + 347. Ann Arbor, Mich. 1910.

This volume, published by authorization of the society at its tenth annual meeting in 1909, is devoted (after a brief introductory sketch) to accounts of its meetings, including the two informal conferences which preceded its organization, and to abstracts of the papers presented. The last occupy by far the greater part of the work. To review them would be practically to give an account of the astronomical work done in this country in the last twelve years.

Perhaps the strongest impression left after glancing over them is of the advance that has been made, both in the means and results of observation, since the first conference was held at the dedication of the Yerkes Observatory in 1897.

To the members of the society nothing is likely to be more prominent in memory than the inspiration resulting from its meetings, with their abundant opportunity for conference and discussion, and the cordial hospitality shown at the various places of meeting.

Henry Norris Russell

Princeton University

SPECIAL ARTICLES

The "dilute" forms of yellow mice[1]

A modified variety of the dark-eyed black mouse exists in the dilute black or "blue" of the fanciers. When the hairs of these dilute black animals are examined microscopically and compared with those of ordinary or intense blacks, it will be found that a reduction in the number of the pigment granules has taken place. It is not a large reduction, but is nevertheless sufficiently pronounced to be recognized with considerable ease. The same relation is observable between the intense and the dilute varieties of brown, known as "chocolate" and "silver-fawn," respectively, as well as in the corresponding varieties of black-agouti and brown-agouti.

The hairs of cream, or light yellow, mice, as compared with those of ordinary yellow mice, show, when examined microscopically, a very pronounced reduction in the amount of yellow pigment. This reduction is clearly more complete than that seen in the dilute black or dilute brown forms. Moreover, the last two forms named are remarkably constant in their degree of dilution, while cream forms may vary through deep creams to light yellows and from these to deep red-orange forms showing a full complement of pigment granules.

It is known that in the case of brown and black the dilute condition behaves as an independent unit-character, and so can be transferred in crosses from brown to black or *vice versa*. The dilute condition is also recessive to the intense, in crosses, so that dilute animals bred together produce only dilute offspring.

The question now arises whether "cream"

[1] Contributions from the Laboratory of Genetics, Bussey Institution, Harvard University, No. 11.

is a dilute form of yellow corresponding in nature to the dilute forms of black and brown. A very simple and direct test of this matter is obtained by breeding "cream" animals together.

Cream-colored, like all other shades of yellow mice, are regularly heterozygous, producing black or brown pigmented young as well as those which are yellow, the yellows being to the non-yellows approximately as two to one.[2] Now if the "cream" condition of yellow is produced by the same factor as the dilute condition of black and brown, the "creams" bred together should produce non-yellow young all of which are *dilute*, since, as stated, dilution is recessive in nature.

Such, however, is not the case. Cream animals mated together produce only cream or light-colored yellow offspring, but the black or brown pigmented young which they produce are commonly of full intensity. Accordingly, it follows that the "cream" modification of yellow is different in nature from the dilute modification of black and must be produced by a different factor.

This fact being established, search was begun for a type of yellow which when bred by itself would produce yellows and dilute forms of black and brown. Such yellows should, when obtained, be distinguishable from the intense yellow as well as the "cream" type, and should show on microscopic examination of the hair a condition of pigment reduction equal in amount to that seen in the dilute black or dilute brown forms.

Such yellows have been obtained. They may be deep red, light cream, or any of the intermediate gradations, but they possess an extremely characteristic washed-out dull appearance, which serves to distinguish them clearly from intense forms, even though these be extremely light colored.

Since this form of yellow occurs in all the gradations from "red" to "cream," it is apparent that it represents an independent form of pigment reduction; and since, unlike the "cream" reduction, it is transferable to black or brown, it is safe to class it as the *dilute form of yellow*.

The fact that black and brown pigment is present in agouti animals in a presumably constant degree of intensity and that the yellow pigment may independently vary in these animals from cream to deep red, may possibly serve to explain the marked variations seen in the type known as intense black agouti (golden agouti).

A table showing the result of crossing "creams" (light yellow) *inter se* follows.

TABLE I

Parents, ''cream'' × ''cream'';
Offspring, ''cream'' 31, black 10, brown 14.
(*light yellow*) (*intense*) (*intense*)

From Table I. it will be seen that non-yellow young of a dilute character are not produced by mating cream-colored animals *inter se*. On the other hand, such young have been produced by dilute yellows crossed *inter se*, as shown by Table II.

TABLE II

Parents, dilute yellow × dilute yellow;
Offspring, dilute yellow 95, dilute non-yellow 52.

Further, when dilute yellows are mated with dilute non-yellows the non-yellow offspring are all dilute (see Table III.).

TABLE III

Parents, dilute yellow × dilute non-yellow;
Offspring, dilute yellow 38, dilute non-yellow 37.

In the foregoing account dark-eyed yellows are alone used in computing the numerical results. Experiments with pink-eyed yellow forms have been conducted, but the data have not yet been tabulated.

C. C. LITTLE

May 22, 1911

DIMORPHISM OF THE GAMETES OF ŒNOTHERA[1]

PROFESSOR DE VRIES[2] has brought to light a

[2] See SCIENCE, N. S., Vol. XXXII., No. 833, pp. 868–870.

[1] Read before the Botanical Society of Washington, May 2, 1911.

[2] ''Ueber doppeltreziproke Bastarde von *Œnothera biennis* L. und *O. muricata* L.,'' in *Biologisches Centralblatt*, 31: 97–104, No. 4, February 15, 1911.

remarkable form of dimorphism of the gametes of several species of evening primrose. If reciprocal hybrids are made between, say, *Œnothera biennis* and *O. muricata,* the resulting hybrids are very unlike and strongly patrocline, in both cases presenting only slight traces of any influence by the female parent. Detailed investigations now under way by Professor de Vries show that the ovules and pollen grains carry quite different hereditary tendencies. The common *Œnothera biennis* represents the form inherited through the pollen, the characters carried by the ovules being recessive. If *O. biennis* is crossed with pollen of another species over which it is dominant, the result is to bring into expression the form inherited through the ovules, which de Vries calls the *conica* form. This form is obtained if *Œnothera biennis* is crossed with pollen of *O. muricata, O. Hookeri, O. strigosa,* etc. Similarly, if *Œnothera muricata* is pollinated with *O. biennis* (Chicago form), *O. Hookeri* and *O. strigosa,* it yields what de Vries calls the *frigida* form which represents the form of *O. muricata* inherited through the ovules.

The ordinary form of *O. biennis* represents what de Vries calls the pollen picture of this species, the pollen form (*biennis*) being dominant over the ovule form (*conica*). The same is true of *O. muricata,* the ovule form (*frigida*) being recessive to the pollen form (*muricata*).

This property of producing gametes having diverse hereditary qualities is termed by Professor de Vries "*Heterogamie,*" but as this term is already used in many different senses it seems best to propose instead a new term, *allogametism,* after the analogy of such words as allotropism.

The pollen grains and ovules of *Œnothera biennis* and *O. muricata* would constitute *allogametes.*

If B represents *Œnothera biennis,* M, *Œnothera muricata,* H, *Œnothera Hookeri,* and L, *Œnothera Lamarckiana,* the second term being the male parent in each case, some of the remarkable results of allogametism are as follows:

Hybrid BM = *conica* (ovule picture of *O. biennis*).
Hybrid MB = *biennis* (pollen picture of *O. biennis*).
Hybrid MH = *frigida* (ovule picture of *O. muricata*).
Hybrid LM = *muricata* (pollen picture of *O. muricata*).

In such allogametic species of *Œnothera* the diversity of the gametes of the two sexes does not become apparent unless reciprocal hybrids are made with another species, whereupon very different results are obtained, depending upon which species is used as the female parent.

In case the reciprocal hybrids of the same two parents are crossed, what de Vries calls double reciprocal hybrids result, thus

$$BM \times MB = B,$$
$$MB \times BM = M.$$

In such cases the "peripheral"[3] grand parent shows complete dominance, while the "central"[3] grand parent is eliminated, thus:

$$B(M) \times (M)B = B,$$
$$M(B) \times (B)M = M.$$

If a patrocline hybrid is crossed with pollen of the paternal species, what de Vries calls *iterative* hybrids result, exactly like the first hybrid and very like the paternal species, thus:

$$MB \times B = MB = B,$$
$$B \times BM = BM = M.$$

The central term in the formula is eliminated in this case, $M(B) \times B = MB = B$.

If a patrocline hybrid be crossed with pollen of the mother species, what de Vries calls *sesqui-reciprocal* hybrids result in which the grandpaternal species is eliminated, thus:

$$MB \times M = M,$$
$$BM \times B = B.$$

The central term in the formula is again eliminated, $M(B) \times M = M$.

Not all the characters of the species were found to be transmitted allogametically. In

[3] So called from the position in the above formulæ.

O. biennis and *O. muricata,* however, the only exception seems to be in the size and form of the petals.

The very interesting discovery was made by J. M. Geerts[4] that approximately half the ovules and half the pollen grains of the allogametic species of *Œnothera* are abortive. It is suggested that in case of *Œnothera biennis* only those ovules that carry the *conica* form develop, those that should carry the *biennis* form aborting. On the other hand only those pollen grains which carry the *biennis* form mature, those that should carry the *conica* form failing to develop.

WALTER T. SWINGLE

STUDIES IN ARTERIOSCLEROSIS

MUCH has appeared in the literature in recent years upon the etiology and process of development of arteriosclerosis. Many observations have been made upon the human subject and also in experimental animals, of points co-relating certain factors with the production of disease in the arterial tree. In most instances these factors have been carefully studied by competent observers and in many instances the results have been verified by others.

The gathering of facts concerning arteriosclerosis is quite simple—the interpretation of these involves much difficulty. In carrying out any experiment or in offering reasons for a given result, we are constantly reminded of the manifold factors which enter a given experiment or which are naturally present. Often our experiment on animals only induces altered conditions which indirectly bring about the result we are seeking. That the greatest care must be exercised in drawing inferences from animal experimentation is well illustrated in studies upon arteriosclerosis.

Recently Levin and Larkin[1] have published the results of their experiments on dogs, in which by producing an arterio-venous anastomosis between the external jugular vein and the external carotid artery, they arrive at the sweeping conclusion that "arteriosclerosis can not be artificially induced in a previously healthy blood-vessel by a change in the blood pressure alone." To *this type* of conclusion we must take exception.

Levin and Larkin, experimenting on ten dogs, joined the external carotid artery to the external jugular vein. In two of these dogs thrombosis occurred close to the line of suture in the vessels. All but two of the remaining eight animals received injections of adrenalin at varying periods. These eight dogs, which form the positive results and from which the above positive statement respecting arteriosclerosis was made, were allowed to live 102, 38, 72, 15, 124 and 58 and 44 days, respectively.

No one, who has studied diverse pathological lesions, will deny that the distribution of various lesions in organs is not uniform in the animal world. Man is particularly subject to lesions of the circulatory system—a condition not so frequent in lower animals. Rabbits and horses occasionally suffer from arterial lesions—more often seen in the older animals and in certain breeds. Dogs and cats rarely develop lesions in the arteries, even under the most trying circumstances.

This varying susceptibility still awaits an explanation, but in the face of our ignorance in the matter, we must assume the greatest care in drawing broad conclusions or in proposing far reaching principles. Negative experimental results for the dog have no positive bearing upon experimental facts observed in other animals.

Much criticism is offered against the use of the rabbit for experiments upon the circulatory system. The comment has been that spontaneous arterial disease occurs in this animal. And yet none of the critics offer any suggestion for the cause of this spontaneous lesion! Properly selected animals and controlled experiments can reduce the error of "spontaneous" disease to almost a vanishing point. The very feature, in the rabbit, of readily reacting in its arterial tree to different

[4] Geerts, J. M., "Beiträge zur Cytologie und der partiellen Sterilibät von *Œnothera Lamarkiana,*" in *Recueil des travaux botaniques néerlandais,* 5: 93–208, pl. 5–22 (N. 2–4, June, 1909), also published as a separate article.

[1] *Jour. Exper. Med.,* 1911, XIII., p. 24.

noxæ, determines its usefulness for studying the diseases of the circulation.

In the experiments of the above-cited authors, the observations were made upon the venous segments of the anastomosis. Here although in only some of the animals the vein was noted to be dilated, it is concluded that an increased blood pressure existed in all. It is not at all clear to what extent the blood pressure was increased when the external carotid and external jugular were united. With the free anastomosis which exists (varying much in individual animals), between the venous channels of the neck, it is possible that an increase of pressure exists for only a short period after the successful anastomosis.[2]

It is further to be pointed out that various observers have recorded that periodic and intermittently increased blood pressures have quite a different effect upon the blood vessels than a constant and continuous one. The periodically increased pressure is found commonly in man, and if we may draw any conclusions from the finding of occupation sclerosis (right radial sclerosis in the blacksmith, femoral sclerosis in the policeman), it is that the periodic increase of pressure leads to degenerations and sclerosis in the arteries.

Finally, but of primary importance, the results of observations on veins can not be utilized in drawing conclusions about arteries, as has been done by Levin and Larkin.

Oscar Klotz

University of Pittsburgh,
February, 1911

Presence of Arsenic in Fruit Sprayed with Arsenate of Lead

The spraying of fruits with an arsenical has been practised for a number of years in the control of insects which destroy by eating. The form in which arsenic was first used was Paris green, which, however, proved, for the most part, to be more or less injurious to foliage and fruit on account of the soluble character of the compound. Only within recent years has arsenate of lead come into use. The main reasons for its use as recommended by entomologists was its greater purity and insolubility in water. During the past three years the writer has had occasion to question the use of arsenate of lead as commonly found on the market. Many brands do not show sufficient uniformity in arsenic content, nor is the arsenic found in the proper combination with the lead. When lead nitrate and disodium arsenate or lead acetate and disodium arsenate are combined at least three forms of arsenate of lead may result, namely, ortho-arsenate of lead ($Pb_3(AsO_4)_2$), pyro-arsenate of lead ($Pb_2As_2O_7$) and meta-arsenate of lead ($(PbHAsO_4)_2$). The last named compound is very injurious to foliage and fruit under certain climatic influences; and the pyro-arsenate of lead may become so in the presence of water containing soluble chlorides, sulphates or carbonates. Very few of the waters commonly used to apply arsenate of lead are pure, hence injury may result, although the compound if used with chemically pure water will produce no injury. The ortho-arsenate of lead, however, is practically insoluble in neutral and alkaline solvents.

Besides any apparent injury, such as the spotting or burning of the fruit and foliage, a certain amount of arsenic may be absorbed by the fruit without showing any injury at the time. The occurrence of certain spots on apples held in storage has occupied the attention of the writer for some time. Upon examination, such fruits were found to contain appreciable quantities of arsenic. The badly red-spotted and black-spotted fruits showed approximately twice as much arsenic as fruits from the same lot which showed no spotting. A ten-gram sample of badly spotted apple skin showed 0.05 of a milligram of metallic arsenic. One large Spitzenburg apple showed a total of 0.3 milligram of arsenic calculated as As_2O_5. The fruits were carefully washed so as to exclude from analysis all arsenic that adhered to the surface.

It has also been noted by the writer that certain papers used to wrap apples and pears, a practise common on the Pacific coast, con-

[2] See Carrel and Guthrie, "Surg. Gynac. and Obstet.," 1906, Vol. II.; and Watts, *Bull. Johns Hopkins Hosp.*, 1907, Vol. XVIII.

tain, very frequently, small amounts of arsenic, as well as other substances which may or may not have an injurious effect. It is quite well known that small quantities of arsenic have a tendency to hasten the ripening process in fruits. One instance of particular interest has been noted. A certain shipment of pears was wrapped with two different brands of paper. The pears were of one variety, all from one orchard, and were kept under exactly the same conditions and treated in every way the same, excepting that about one half of the shipment was wrapped with one brand of paper and the rest with another brand. After the fruit had been in storage for some time it was found that the ripening process in one lot was much in advance of the other; the other lot remained normal. After an examination of the whole shipment it was found that the condition of the fruit corresponded exactly with the brand of paper used. It would seem from this that fruit growers should pay particular attention to the quality of paper used for wrapping fruit as well as the quality of arsenate of lead used in spraying the fruit.

P. J. O'GARA

THE AMERICAN PHILOSOPHICAL SOCIETY

THE annual general meeting of the society was held in the hall of the society, Philadelphia, April 20, 21 and 22, at which about sixty papers were presented on scientific and literary topics.

President W. W. Keen, LL.D., and Vice-president E. C. Pickering took turns in presiding at the various sessions.

It has been the custom for several years to devote one half-day session to a symposium on some special topic in science. This year the subject was "Modern Views of Matter and Electricity," and the following papers bearing on this general topic were offered: "The Fundamental Principles," by Professor D. F. Comstock, of Boston; "Radioactivity," by Professor B. B. Boltwood, of New Haven; "Thermionics," by Professor O. W. Richardson, of Princeton; "The Constitution of the Atom," by Professor H. A. Wilson, of Montreal. The general conclusion seems to be that the atom of matter, groups of which compose the molecules of different substances, is built up of much smaller parts, known as electrons, identical with the smallest unit of negative electricity. Sir J. J. Thomson's theory of the atom assumes also a spherical form of positive electricity, throughout which are imbedded the electrons in different numbers according to the kind of atom. It was also explained how it is possible to estimate the actual number of electrons in an atom of any given kind. As the inertia of an electron emitted from the atom of a radioactive substance, such as radium, has been experimentally proved to be a function of its speed, the evidence is strong that all inertia or mass may be electrodynamic in its nature.

At the opening session on Thursday the following papers were read:

Notes on Cannon: Fourteenth and Fifteenth Centuries: CHARLES E. DANA, Philadelphia.

The first absolutely reliable, contemporaneous account we have of cannon is contained in an edict, still to be seen, in Florence, Tuscany, dated 1326. What these cannon looked like or did we shall never know, but with them begins the authentic history of ordnance; back of them is only legend.

Powder was in those early days, as its name implies, a dust; it contained the charcoal and sulphur of to-day, as well as the saltpeter, but far too small a quantity of the last, on account of the difficulty in procuring it. The cost, in the middle of the fourteenth century, was almost prohibitive, cheap at twenty-five dollars a pound, in money of to-day.

The next mention of cannon is of some at the Tower of London in 1338; amongst these were several breech-loaders. Another, in the same year, called a "pot for hurling arrows," was the pride of the arsenal of Rouen, France. The charge for this mighty engine of war was less than an ounce of the badly proportioned dust of that day—termed powder.

It is often asserted that three field-guns were used by the English at Crécy, where, in 1346, they gained so tremendous a victory. One must always remember that a large body of English archers was there present. Every man of them was a dead-shot, firing ten or more arrows a minute from his "longbow"; the effective range was two hundred and fifty yards, every "cloth-yard arrow" was an armor-piercing projectile. Of what use three absurd pop-guns would have been it is difficult to imagine. The interest is purely antiquarian, as these would have been the first field-artillery mentioned in history. That cannon were

used at the siege of Calais, which immediately followed Crécy, there is no doubt whatever.

By the end of the fourteenth century huge bombards, throwing stone balls of two hundred pound weight, were common; later, stone balls weighing a thousand pounds, requiring a gun caliber of over thirty inches, were in use.

The quick-firing, breech-loading guns of the fourteenth and fifteenth centuries, when they were provided with at least four chambers, which chambers looked much like a beer mug and contained the powder charge, could be fired about once in two minutes. These were most effective at sea; fired from the tops, just as our quicker firing guns are, they were used for clearing the deck; loaded with bullets, rusty nails and a general assortment of scraps they were worthy of their name—"murtherers."

The great bombards, and many of the smaller guns in the fourteenth century, were built of longitudinal wrought-iron bars, over which heavy iron rings or bands were driven. The breech, containing the powder-charge, was usually forged, the caliber being about a third that of the chase. The powder-charge was about one eighth to one ninth the weight of the stone projectile. In spite of the smallness of this the bombard had a bad habit of bursting, spreading death in all directions except where it was intended to.

The field-guns at the end of the fifteenth century would not have looked very strange in, say, 1800. For it must not be forgotten that the guns used by Nelson at Trafalgar (1805) differed but little from those used by Howard and Drake against the Spanish Armada, over two hundred years earlier.

The Cost of Living in the Twelfth Century and its Effects: Dana C. Munro, University of Wisconsin.

The rise in the cost of living in the twelfth century was due to a change in the standard of living. Acquaintance with the east, through the crusades, led to a desire for more costly clothing, and fashion began its despotic sway. More luxurious dwellings, oriental spices and other products became common. The amount of money available was greatly increased by the coining of the gold and silver which had been hoarded, by the more rapid circulation of the money, and especially by the use of instruments of credit which became common in the twelfth century.

An era of extravagance ensued which is well depicted in the literature of the age. The average noble was unable to increase his income, which was derived from fixed customary payments. Consequently, to meet his new needs he was compelled to borrow at ruinous rates of interest. The lender was frequently a Jew and much of the ill-will toward the Jews is to be traced to the hostility of the borrowers who were hopelessly in debt.

The peasants profited by the opening of more markets for their agricultural products and were sometimes able to gain their freedom by the payment of a small lump sum when the lord of the manor was hard pressed for money. The merchants profited most by the increase of trade and became factors in the political life of the day. Sumptuary laws were frequent but ineffective.

As yet too little attention has been paid to this change in the standard of living and its effects. There is a great mass of material in the shape of documents, such as the Pipe Rolls, *e. g.*, and there are many references in the contemporary literature. There is an opportunity and need for a number of students to investigate various phases of the subject. This is one of my reasons for presenting this subject here.

Elizabethan Physicians: Felix E. Schelling, University of Pennsylvania.

The Relations of the United States to International Arbitration: Hon. Charlemagne Tower, Philadelphia.

The Early German Immigration and the Immigration Question of To-day: M. D. Learned, University of Pennsylvania.

On the Solution of Linear Differential Equations by Successive Approximations: Preston A. Lambert, Lehigh University.

Generalizations of the Problem of Several Bodies, its Inversion, and an Introductory Account of Recent Progress in its Solution: E. O. Lovett, Rice Institute.

On the Totality of the Substitutions on n Letters which are Commutative with Every Substitution of a Given Group on the Same Letters: G. A. Miller, University of Illinois. (Introduced by Professor C. L. Doolittle.)

Report on the Second Conference of the International Catalogue of Scientific Literature: L. C. Gunnell, Smithsonian Institution. (Introduced by Dr. Cyrus Adler.)

Moreau de Saint Mery and the other French Exiles: Some of our Forgotten Members.

One of the results of the French Revolution was that many of the exiles from France and its West India colonies found a harbor of refuge in

Philadelphia, and some of the most notable among them became members of the American Philosophical Society.

Talleyrand, Noailles, Chastellux, Rochefoucauld Liancourt, Brissot and Volney are known by their books and by their subsequent career in France.

One of the most active in the Philosophical Society was Moreau de Saint Mery, now almost forgotten, but recently rescued from oblivion by the publication of some of the documents from his large collection of 250 volumes, in the *Proceedings* of the Wisconsin Historical Society and the *Canadian Archives*.

Born in the island of Martinique in 1750, dying in Paris in 1819, he was employed in the royal government of Saint Domingo, and published a collection of the laws of the French West Indies. He sent scientific papers to the American Philosophical Society, and was elected a member in 1789. Driven from France, where he was a member of the First Convention, representing the West Indies colonies, he found refuge in Philadelphia.

Here he opened a book store at Second and Walnut Streets, published works of his own on Saint Domingo, one of them translated by William Cobbett, then living in Philadelphia, and his own translation of a book on its prisons by Rochefoucauld Liancourt, and one on China by VanBraam, "of China Hall near Bristol," who had been a member of a Dutch embassy in China, and brought here a large collection of curios from China.

Saint Mery printed a catalogue of books in French, German, Italian, Latin and Greek on sale in his book store, which is quite remarkable for its extent at that period. His book store was quite a meeting place for other French exiles of all parties, Royalists, Girondins, Jacobins, and he and they were frequent visitors to the Philosophical Society and contributors to its *Proceedings*.

Returned to France through the influence of his relative, Josephine, Napoleon gave him in succession important positions, and, as historiographer of the Marine Department, he made the large collection of documents relating to the history of France in America, which is now one of the most important series in the great French Archives.

He was a diligent collector, an intelligent observer and a notable character in his day and generation, and his stay in Philadelphia was not without influence on both countries.

He followed Talleyrand in guiding Napoleon to sell to the United States the vast and unknown Louisiana Territory, so important in the later history and growth of the United States.

When France lost its holdings on the American continent, Saint Mery began to collect historical documents relating to the period when France controlled Canada and Louisiana and disputed with Great Britain possession from the St. Lawrence to the Gulf of Mexico.

Now in his collection, historical students in Canada and Wisconsin find the material for publication on the history of France in America. His zeal for rescuing from destruction these sources of history is now receiving acknowledgment, and his name figures in the works of Aulard and Thwaites, who find in his collection material of great value for their recent contributions to our knowledge of history. Apparently a modest man, his service to the American Philosophical Society, his contribution of his own papers and books and objects of interest for its collection, and in bringing to its meetings many of his fellow exiles, were of value. Some of his countrymen became members of the society, thanks to his introduction, and among them were those who played a large part in the history of France. His own collection of historical documents throws much light on the early French settlements in the United States, and makes the best memorial of his zeal in spreading useful knowledge.

The session on Friday morning was devoted especially to botany, chemistry and astrophysics, and the following papers were presented:

Study of the Tertiary Floras of Atlantic and Gulf Coastal Plain: EDWARD W. BERRY, associate in paleontology, Johns Hopkins University. (Introduced by Dr. J. W. Harshberger.)

The Desert Group Nolineæ (illustrated): WILLIAM TRELEASE, director of the Missouri Botanical Garden, St. Louis.

The Blueberry and its Relation to Acid Soils: F. E. COVILLE, U. S. Department of Agriculture. (Introduced by Dr. J. W. Harshberger.)

Experiments covering a period of five years, with many kinds of soil and nutrient solutions, showed that in all so-called fertile soils the blueberry either does not thrive or it dies outright. In an acid peaty soil, such as occurs in bogs or sandy woods, it grows luxuriantly. Ordinary plants suffer in such soils from nitrogen starvation. The blueberry, however, bears on its roots a fungus which appears to act in a beneficial manner by furnishing nitrogen to the plant.

On the basis of these experiments the blueberry has now been put into actual field culture on a small scale, with every prospect that it will be

made commercially successful. In the field plantings bushes grown from the seed have been chiefly used, but the propagation of superior varieties by layering and by cuttings is now in progress, one of the varieties having berries over half an inch in diameter.

The acid lands on which the blueberry grows best are commonly regarded as of little value agriculturally. Blueberry culture offers a special means for the utilization of such lands.

The blueberry is not alone in its ability to thrive in an acid soil. Experiments with various other plants indicate similar characteristics. For example, the wild trailing arbutus, which has been regarded as exceedingly difficult of cultivation, grows luxuriantly when potted in the acid peaty soil found so successful for the blueberry. Exceptionally beautiful flowering plants have been grown from the seed in less than two years. There is no reason why trailing arbutus can not be added to the choice potted plants of the florists' trade.

It is impossible to foretell to what extent other useful plants than the blueberry will be found to be adapted to acid soils. The cranberry is clearly an acid soil plant. Dr. H. J. Wheeler, of the Rhode Island Agricultural Experiment Station, has shown that the strawberry, the potato, rye, lupin and buckwheat grow as well or a little better without the use of lime. In other words, they are acid soil plants.

It is not altogether a dream to foresee the development of a special acid land agriculture, in which the rotations shall include only such crops as prefer an acid soil or are indifferent to acidity.

The New Cosmogony.

The Extension of the Solar System beyond Neptune and the Connection Existing between Planets and Comets.

The Secular Effects of the Increase of the Sun's Mass upon the Mean Motions, Major Axes and Eccentricities of the Orbits of the Planets: T. J. J. See, Mare Island, Cal.

Extension of Our Knowledge of the Atmosphere: A. L. Rotch, Harvard University. (Introduced by Professor W. M. Davis.)

One Hundred and Seventy-five Parabolic Orbits and other Results deduced from over 6,200 Meteors: C. P. Olivier, of Charlottesville, Va. (Introduced by Professor Cleveland Abbe.)

The Solar Constant of Radiation: C. D. Abbott, Smithsonian Institution. (Introduced by Dr. C. D. Walcott.)

If we had no eyes we should still know of the sun by the feeling of warmth. The most exact measurements of the intensity of the rays of the sun, whether they be visible to the eye or affect the photographic plate or not, are made by an electrical thermometer called the bolometer. This instrument is so sensitive that a millionth part of a degree change of temperature is recorded by it. For seven years the bolometer has been used by the staff of the Astrophysical Observatory of the Smithsonian Institution to measure the solar constant of radiation. This constant represents the number of degrees (centigrade) which one gram of water would rise in temperature if all the solar radiation which could pass through an opening one centimeter square outside the earth's atmosphere, but at the earth's mean distance from the sun, could be used for one minute to heat the water. As all life and almost all forces on the earth depend on the supply of solar rays, the solar constant of radiation is at least equal in importance to the knowledge of the sun's distance.

The value of the solar constant was unknown within wide limits only five years ago. It is now believed to be within 1 per cent. of 1.93 calories per square centimeter per minute. Measurements made at Washington (sea level), Mt. Wilson (one mile elevation and Mt. Whitney (nearly three miles elevation) agree in fixing this conclusion.

Nearly 500 determinations have been made. They indicate that the value is not really a "constant," but fluctuates about the mean just given within a range of 8 per cent. This conclusion means that the sun is a variable star. It is hoped soon to verify it completely, and it may prove for meteorology hardly less important than the determination of the mean value of the solar constant itself.

Some Curiosities in the Motions of Asteroids: Ernest W. Brown, professor of mathematics, Yale University.

Spectroscopic Proof of the Repulsion by the Sun of Gaseous Molecules in the Tail of Halley's Comet: Percival Lowell, director of Lowell Observatory, Flagstaff, Ariz.

Self-luminous Night Haze: Edward E. Barnard, astronomer, Yerkes Observatory, Williams Bay, Wis.

Some Peculiarities in the Motions of the Stars: W. W. Campbell, director of Lick Observatory, Mt. Hamilton, Cal.

Taking a Census of the Chemical Industries: Charles E. Munroe, professor of chemistry, George Washington University, Washington.

Some Recent Results in Connection with the Power of Solutions to Absorb Light: HARRY C. JONES, professor of physical chemistry, Johns Hopkins University.

The Properties of Salt Solutions in Relation to the Ionic Theory: ARTHUR A. NOYES, professor of theoretical chemistry, Massachusetts Institute of Technology. (Introduced by Dr. James W. Holland.)

The Atomic Weight of Vanadium: GUSTAVUS HINRICHS, of St. Louis. (Introduced by Professor Amos P. Brown.)

Quinazolone Azo Dyestuffs: A New Group of Azo Dyes: MARSTON TAYLOR BOGERT, head of School of Chemistry, Columbia University, New York.

The Friday afternoon meeting was devoted mostly to geology and to biology.

The following papers were read:

Shore and Off-shore Deposits of Silurian Age in Pennsylvania: GILBERT VAN INGEN, of Princeton University. (Introduced by Professor W. P. Scott.)

The lithological and faunal characteristics of the Silurian formations were briefly described and the changes in these features were interpreted in terms of their geographic positions in respect of the shore lines and open seas of that time. The marine oolitic iron ores of the center of the basin were shown to change in shoreward directions to hematitic sandstones of much greater thickness and finally to red and olive quartzites, which are equivalents of part of the Shawangunk grit of the northeastern Appalachians. The conclusion is reached that the Shawangunk grit is of Medina-Clinton-Niagaran age and all older than the Salina to which it has lately been referred.

Tertiary Formations of Northwestern Wyoming: WILLIAM J. SINCLAIR, of Princeton University. (Introduced by Professor W. B. Scott.)

Mr. Sinclair gave a rapid review of the stratigraphy of the Wind River and Bighorn basins, followed by a discussion of the color banding in the Eocene clays, which he correlated with climatic changes.

On a New Phytosaur from the Triassic of Pennsylvania: WILLIAM B. SCOTT, of Princeton University.

Alimentation of Existing Continental Glaciers: W. H. HOBBS, of University of Michigan.

It was in the Alps of Switzerland that the early studies and by far the larger number of subsequent investigations of glaciers have been made. The Swiss type of glacier is one of the most diminutive, but as the theory of former continental glaciation was derived from these studies of puny glaciers, it is not surprising that their attributes were carried over unchanged to the reconstructed extinct types thousands and even tens of thousands of times larger, and this before any continental glaciers had actually been studied. The recent explorations of Norwegian, German, Swedish and Danish explorers, but more than all of Peary in Greenland; and of Scott, Nordenskiöld, von Drygalski and others, but especially of Shackleton in Antarctica, have at last afforded us with observations upon the existing continental glaciers. When these reports are carefully studied and compared, it is found that as regards their form, their erosional processes, and especially their nourishment and waste, continental glaciers are as different as possible from those of the Alpine type. Instead of being nourished by snow precipitated from *surface* air currents which are forced to *rise*, their snow supply is derived from the fine ice grains contained in *high level* cirrus clouds which have been *drawn down* to the glacier surface, been melted, and there reprecipitated. This action is the work of a refrigerating air engine which is developed directly by the snow-ice mass itself. The paper is illustrated by lantern slides.

On the Formation of Coal Beds: J. J. STEVENSON, University of the City of New York.

Two hypotheses, presented to explain accumulation of coal in beds, have been in conflict for almost a century and a half. One asserts that the vegetable material was transported by running water and deposited, as were the enclosing sandstones and shales; the other assigns to transport an insignificant share and maintains that the vegetation grew where the coal bed is now found.

The disputants agree practically on what may be termed facts of observation, such as the nature of the material and the structure of the beds; but the parting comes in the effort to explain the phenomena by reasoning backward from known conditions of our own time. There is room for surprise when one discovers that phenomena, regarded by one writer as final arguments in support of his hypothesis, are regarded by another as equally final in support of the contrary doctrine. Too often, the reasoning is from the hypothesis to the facts and the *a priori* argument seems to be based on an imperfect knowledge of present phenomena or on a purely local study.

Ten years ago I began systematic study of conditions throughout the vast Appalachian basin, hoping to find there enough information for solution of the problem involved; but the results were far from sufficient and study of other regions became necessary. This required examination of hundreds of publications, large and small—and the examination is still far from complete, for the literature, to speak moderately, is sufficiently extensive and, within the last quarter century, sufficiently intensive. While plodding through it, I discovered that much of what has been regarded as new in later days is really very old. The work of earlier students, buried in publications of learned societies, has passed into oblivion. In some instances, important observations have been recorded incidentally in discussion of other topics. Often, the work of an investigator is known only through citations, which, separated from their context, are apt to give a wrong conception of the author's opinions. As the examination advanced, I became convinced that it would be well to present, without comment, a synopsis of each work that seemed to have an important bearing on the subject, that the development of opinion might be made clear and that proper credit might be assigned to men who did excellent work with meager opportunity. Such a presentation seemed also likely to serve as a proper foundation for the general discussion and it is offered here as the first part of a monograph upon the formation of coal beds.

As the study advanced, the elements of the problem were found to be more numerous and more complicated than had been supposed. It has become essential to consider in detail some subjects of which many of the disputants on both sides appear to have very indefinite conceptions.

The second part of the monograph will consider the flexibility of the earth's crust as illustrated in the history of North America; the phenomena of rain and floods; the features of swamps and marshes; the buried forests of modern and ancient times; with other topics of similar import.

The third part will consider the various deposits of the Coal Measures, sandstones, shales, limestones and coals; the effort will be made to determine the sources and the mode of distribution of the inorganic materials; the origin of the coal and the causes of its variation in character; its mode of occurrence and the structure of coal beds.

The fourth part will sum up the results in an effort to show their bearing on the solution of the problem.

Problems in Petrology: J. P. Iddings, U. S. Geological Survey. (Introduced by President Keen.)

Front Range of the Rocky Mountains in Colorado: W. M. Davis, of Harvard College.

The Front Range of the Rocky Mountains in Colorado, now easily accessible by various railroad lines which enter and cross it from Denver and Colorado Springs, is an unusually fine example of a mountain highland, which in a former cycle of erosion was reduced to moderate relief, and which since elevation to its present altitude has been submaturely dissected by its streams. The highland is surmounted by numerous hills and mountains of from 500 to 2,500 feet relief, which represent the unconsumed residuals of the former cycle of erosion, and which, therefore, presumably consist of the most resistant rocks of the region. The uplift of the mountain belt to its present altitude was not perfectly uniform, but arched gently from the plains westward; thus the crest of the range seems to correspond to the crest of the arched uplift. A notable feature of the higher valley heads, among the surmounting mountains near the range crest, is the occurrence of numerous amphitheaters or cirques, and overdeepened valley troughs, the work of glaciers which for a moderate time, as geological time is reckoned, replaced the water streams in the highest districts. The contrast between forms due to ordinary or normal erosional processes and to glacial erosion is thus displayed with unusual clearness.

Supposed Recent Subsidence of the Atlantic Coast: D. W. Johnson, of Harvard College. (Introduced by W. M. Morris.)

The author briefly reviewed the evidence in support of the generally accepted theory that the Atlantic Coast is subsiding at the rate of from one to two feet per century, and showed that the phenomena supposed to indicate subsidence might be produced by fluctuations in the height of ordinary high tides resulting from changes in the form of the shore line. A study of the Atlantic shore line indicates that conditions are there favorable to marked local changes in the height of the tides, independently of any general movement of the land. On the other hand, the structure of certain beaches along the coast affords very strong proof that there can have been no long-continued progressive subsidence of the coast

within the last few thousand years. The theory of fluctuating tidal heights, and the theory of stability of the land mass were illustrated by selected examples of shore-line phenomena.

Relation of Isostasy to the Elevation of Mountains: H. F. REID, of Johns Hopkins University.

The work of many investigators and more especially the recent work of Dr. Hayford has shown that the earth is practically in isostatic equilibrium. It follows that mountains can not be due to tangential compression or to the increase of matter in the mountains themselves, but must be due to forces of elevation resulting from the expansion of the material under the mountains. Such vertical forces would in many cases cause normal faulting without tangential tension.

The Transpiration of Air through a Partition of Water: Elliptic Interference with Reflecting Gratings: CARL BARUS, of Brown University.

A Phenomenon of Vision: On Disruptive Discharges of Electricity through a Flame: F. E. NIPHER, of Washington University.

The High Voltage Corona in Air: J. B. WHITEHEAD, of Johns Hopkins University. (Introduced by Professor Ames.)

The author described the limitation to the long-distance electrical transmission of power imposed by the insulating properties of the air, and a new method for determining accurately a voltage at which the air in the neighborhood of electric wires and cables will break down; and also gave the results of a series of experiments on the influence of the size of the wire, the stranding of the wire into a cable, the frequency, the pressure, the temperature and the moisture content of the air. He also reviewed the bearing of present physical knowledge on the nature of the phenomena which are involved.

The Nature and Causes of Embryonic Differentiation: E. G. CONKLIN, of Princeton University.

The Origin and Significance of the Primitive Nervous System: G. H. PARKER, of Harvard University. (Introduced by Dr. H. H. Donaldson.)

On Friday evening Professor Svante Auguste Arrhenius gave a lecture at the hall of the College of Physicians on "The Physical Conditions of the Planet Mars."

The lecture was followed by a reception.

The speaker called attention to the many similarities between Mars and the earth which have led some to think Mars is inhabited, but gave it as his opinion that later investigations are not favorable to this view.

On Saturday morning at 9:30 the society held an executive session, at which candidates for membership were balloted for. As a result the following were elected as members of the society: George A. Barton, A.M., Ph.D., Bryn Mawr, Pa.; Bertram Borden Boltwood, Ph.D., New Haven, Conn.; Lewis Boss, A.M., LL.D., Albany, N. Y.; John Mason Clarke, Ph.D., LL.D., Albany, N. Y.; W. M. Late Coplin, M.D., Philadelphia; John Dewey, Ph.D., LL.D., New York City; Leland Ossian Howard, Ph.D., Washington, D. C.; Joseph P. Iddings, Sc.D. (Yale, 1907), Chicago; Alba B. Johnson, Rosemont, Pa.; Arthur Amos Noyes, Ph.D., Sc.L., LL.D., Boston; George Howard Parker, S.D., Cambridge, Mass.; A. Lawrence Rotch, S.B., A.M. (Hon. Harvard), Boston; Leo S. Rowe, Ph.D., LL.D., Philadelphia; William T. Sedgwick, Ph.D., Hon. Sc.D. (Yale, 1909), Brookline, Mass.; Augustus Trowbridge, Ph.D. (Berlin), Princeton, N. J.; Svante Auguste Arrhenius, Stockholm; Jean Baptiste Edouarde Bornet, Paris; Sir John Murray, K.C.B., F.R.S., LL.D., Sc.D., Edinburgh.

At ten o'clock the morning session for the reading of papers opened, the following being presented:

The Secretion of the Adrenal Glands during Emotional Excitement: WALTER B. CANNON, of Harvard University.

The adrenal glands and the sympathetic nervous system are intimately related. The sympathetic system innervates the glands, and the glands in turn secrete a substance that affects bodily structures precisely as the sympathetic system affects them. The sympathetic system is aroused to activity in states of emotional excitement. Examination of the blood of excited animals reveals the presence of adrenal secretion which was not found in the blood before the excitement. Possibly the adrenal secretion continues the excited state. Possibly also the adrenal secretion caused by emotional disturbances has some of the effects produced by injection of the substance—such as glycosuria and atheroma of arteries. Indeed, two of my students, Shohl and Wright, have recently shown that glycosuria can be produced in the cat by fright. The suggestion, however, must be put to further experimental test.

On the Coagulation of Blood: W. H. HOWELL, Johns Hopkins University.

The theory of the coagulation of blood most commonly accepted at the present time holds that

three of the four necessary factors in the process are present in the circulating blood, but that this fourth which initiates the process in shed blood is furnished by the tissues outside the blood or by the disintegration of corpuscular elements in the blood itself. This fourth factor is an organic substance of the nature of a kinase which in conjunction with the calcium salts of the blood serves to activate the prothrombin, also present in the blood, to thrombin. The thrombin then acts upon the fibrinogen and converts it to fibrin, which constitutes the essential phenomenon of clotting. In opposition to this theory the author gave experimental evidence to show that in normal blood the fluidity is due to the constant presence of an antithrombin, and that in shed blood the tissue elements furnish a substance, thromboplastin, which neutralizes the antithrombin and thus allows clotting to take place. In the vertebrates below the mammals, the thromboplastin is furnished by the cells of the outside tissues and without their cooperation clotting would not occur. In the mammals thromboplastin is furnished by elements in the blood itself, the platelets, so that the blood may clot promptly without cooperation on the part of the outside tissues. In human beings the condition known as hemophilia, in which there is delayed clotting and danger of fatal hemorrhage, the defect is due not to a lack of kinase in the tissues as a whole, the view usually taught at present, but to an excess of the antithrombin normally present in the blood.

Abnormal Forms of Life and their Application: Alexis Carrel, of the Rockefeller Institute.

The author stated the results of some remarkable experiments on the tenure of life in certain tissues when removed from the body and kept in cold storage.

The Cyclic Changes in the Mammalian Ovary: Leo Loeb, of the St. Louis Skin and Cancer Hospital.

In the mammalian ovary cyclic changes of a very far-reaching character take place. They concern the follicles, corpora lutea and ova. There exists in the ovary a mechanism (in the corpus luteum) regulating those changes. The corpus luteum prolongs the sexual cycle not by retarding the maturation of the follicles, but by preventing the rupture of the mature follicles. My recent observations make it very probable that a partial parthenogenetic development of some ova accompany those cyclic changes in the follicles in a certain percentage of animals.

The Origin of the Porpoises of the Family Delphinidæ: F. W. True, of the U. S. National Museum, Washington, D. C.

Among the fossil remains of cetaceans obtained a short time since by the National Museum from the Miocene formation of Maryland, is a nearly complete skeleton of a porpoise, which, on examination, proves to be a delphinoid form, that is, a species which may be referred to the family Delphinidæ, but has tuberculate teeth. This important specimen enables us to solve, in part, the hitherto unsolved problem of the origin of the typical porpoises of to-day. It now appears unquestionable that they were derived from forms having teeth with tuberculate or serrate crowns, rugose enamel, and anterior and posterior longitudinal ridges. This form of teeth is indicated in the recent delphinoid genus *Stano,* in which the crowns have rugose enamel, and, as I have lately discovered, traces of anterior and posterior ridges.

Phylogenetic Association in Relation to the Emotions: George Crile, professor of clinical surgery, Western Reserve University, Cleveland, O.

Helios and Saturn: Morris Jastrow, Jr., of the University of Pennsylvania.

On the Religion of the Sikhs: Maurier Bloomfield, of Johns Hopkins University.

An Ancient Protest Against the Curse on Eve: Paul Haupt, of Johns Hopkins University.

In the biblical legend of the fall of man, which symbolizes the first connubial intercourse, the Lord pronounced a curse on Eve, saying, "I will greatly multiply thy sorrow and thy sighing. In pain thou wilt bear children. Nevertheless, thy desire shall be to thy husband, and he shall rule over thee" (Genesis 3:16).

We all know what the forbidden fruit in the Garden of Eden means. He who eats of it loses his child-like innocence, his eyes are opened; just as Adam and Eve perceived that they were naked. Not to know good and evil, that is, what is wholesome and injurious, means to be like a child.

We find this phrase in the eighteenth book of the Odyssey, verse 228. In the Bible it is used also of the second childhood. Barzillai of Gilead answered David, when the king asked him to follow him to Jerusalem, "I am this day fourscore years old, and can no longer discern between good and evil"—that is, My intellect is impaired by old age, I have become again like a child.

An ancient protest against the curse on Eve in Genesis 3:16 is found in the story of Cain and Abel, where we read, "And unto thee shall be his

desire, and thou shalt rule over him.'' The story of the fall of man and the story of Cain and Abel were, it may be supposed, written in parallel columns.

The author of the ancient protest against the curse on Eve (who may have been a woman or a man under the influence of a woman, a species of genus *Homo* which is common) wrote this ''suffragettic'' gloss on the space between the two columns. Afterwards it crept into the text of the column containing the story of Cain and Abel. The introductory verse connecting Cain and Abel and Adam and Eve is a subsequent addition. The name Cain is explained there (Genesis 4:1) as being connected with the verb ''canah,'' to produce. When Eve bare Cain she said, ''I have produced a man as well as the Lord. Just as the Lord formed me from the rib He took from Adam, so I have produced now a new human being.''

Some people think that when the Lord created Eve he took not only a rib from Adam, but his backbone. Most of us have all our ribs. If man eats his bread in the sweat of his face till he returneth unto the ground, and if woman bring forth children born to suffer, it is due to the forbidden fruit. Schiller says the fabric of the world is held together by hunger and love.

Theories of Totemism: E. WASHBURN HOPKINS, Yale University.

He considered first the definition of totemism and the necessity of understanding the different religious systems which go by the name of totemism. He showed that totemism must be disentangled from various accretions which have grown up with it before it is possible to discuss the essence of true totemism. When this is done, much that has affected and even produced some of the theories falls away and at the end a comparatively simple belief is revealed which has been built up into various sorts of totemism, so that it is unnecessary to assume a graded and uniform growth in every kind of totemism. Apparently later stages may come comparatively early. The latest theory of Frazer was examined and compared with that of Lang and that of Wundt. Besides this analysis and critique of older theories a new contribution to the theory of utility was made by the presentation for the first time of matter drawn from Sanskrit texts in which practically the same view is represented as that held by the ancient troglodytes. Apart from some variations the most common direct cause of totemism is economic rather than religious and then blends with other religious factors, but is not so fundamentally, though there are forms of totemism which are based on religious conceptions and helping to its spiritualistic development.

The New History: J. H. ROBINSON, of Columbia University. (Introduced by Professor Cheyney.)

Eggettes: a Conservation of Fuel: R. P. FIELD, of Philadelphia.

This paper dealt briefly with the general subject of the utilization of slack coal by manufacturing it into small briquettes, which are called eggettes, and showed that a binder which does not contain pitch or any kindred material is preferable for household use, and that by actual test the eggettes under consideration are cheaper than either anthracite or bituminous coal in the regular sizes, crushed coke, wood, oil or gas. There was then given a brief description with lantern slides of the machinery used to manufacture these eggettes, and a few statistical tables.

On Saturday afternoon besides the symposium and the papers in connection with it already mentioned a portrait of Thomas Hopkinson, first president of the American Philosophical Society, was presented by Leslie W. Miller, principal of the School of Industrial Art, Philadelphia; also an obituary notice of Professor Jakob H. van't Hoff, by Harry C. Jones, of Johns Hopkins University.

At the annual banquet on Saturday evening about one hundred members and guests were present, the president, Dr. Keen, presiding. Toasts were responded to as follows: ''The Memory of Franklin,'' by President Schurman, of Cornell; ''Our Universities,'' by Count von Bernstorff and President Hadley, of Yale; ''Our Sister Societies,'' by Professor W. M. Davis and Sir John Murray; ''The American Philosophical Society,'' by Professor E. C. Pickering.

Thus ended one of the most successful meetings in the history of the society.

ARTHUR W. GOODSPEED,
Secretary

SOCIETIES AND ACADEMIES

THE WASHINGTON ACADEMY OF SCIENCES

THE seventy-second meeting of the Washington Academy of Sciences, a joint meeting with the Washington Society of Engineers, was held in the salon of the steamer *Southland* the evening of April 28, 1911, while en route from Washington to Norfolk, Va., President F. W. Clarke, of the academy, presided.

A symposium on the Dismal Swamp had been

requested, and the committee on meetings decided to include an excursion to the swamp itself and to have the technical papers presented during the first stage of the trip. This plan proved to be eminently practicable, and there is every reason why similar plans that bring people so pleasantly together should be more frequently adopted by scientific societies, for, after all, it is personal acquaintance and private discussion that count for most in such organizations.

The first paper of the evening was by Mr. E. W. Shaw, who described the "Geography and Geology of the Dismal Swamp." The various plateaus and old shorelines of eastern Virginia were pointed out and their formation explained. The swamp is of recent origin, geologically speaking, and in general is well understood, though the existence of a lake near its center is a distinct puzzle, for the solution of which several more or less plausible theories have been advanced.

The second speaker, Dr. C. A. Davis, discussed "Peat Deposits," a subject of which he is a, if not the, recognized master. It was explained that the Dismal Swamp is a great coal field in the making; that it is covered with a layer of peat as much as fifteen feet thick in places, and that portions of this might even now be valuable as fuel.

The next paper was by Mr. R. Zon, whose subject was "The Forest Types in the Dismal Swamp." After a few introductory and general remarks on the relation of forests to climate and soil, the speaker described in greater detail the principal trees of the swamp, especially the cypress and the black gum.

Mr. F. V. Coville gave an interesting account of the "Plant Life in the Dismal Swamp," and made his many listeners anxious for the morrow when they were to see for themselves the yellow jasmine in bloom, the dense cane brakes and the many other wonders of plant life in their native jungle.

Dr. F. W. True told of the "Ground Animals of the Swamp." As these are not numerous, consisting mainly of musk and other rats, swamp rabbits and the like, the speaker so widened his talk as to include fishes, of which there are many varieties; bears, of which there is an abundance; and snakes, of which there is said to be a superabundance.

The last speaker of the evening, Dr. C. Hart Merriam, had for his subject, "The Birds of the Swamp." But as snake stories seemed to take unusually well, and as birds are only feathered reptiles, Dr. Merriam began his talk with an account of certain varieties of snakes that abound in the Dismal Swamp—rattlesnakes, copperheads, water moccasins, king snakes, black snakes, water snakes and just plain snakes. Having disposed of the snakes, the speaker next described the large variety of birds that have been found in the swamp, and so painted their beauty that, for the time being, even the snakes were forgotten.

From Norfolk, Va., the entire party of about 135 was taken into the swamp and even to Lake Drummond, as the guests of and on boats especially provided by the Lake Drummond Canal and Water Company.

Many returned to Norfolk the same day, while others camped out near the banks of the lake and returned to Norfolk the following day.

In every particular the excursion was a delightful one, due to the unusualness and the beauty of the place visited; to the exceptional courtesies, including even a complimentary luncheon, of the Lake Drummond Canal and Water Company; and to the untiring supervision of the genial David T. Day, who not only planned the details of the trip but also secured their execution without a single hitch.

W. J. Humphreys,
Secretary

The Philosophical Society of Washington

The 695th meeting was held on May 6, 1911, Vice-president Fischer in the chair. Two papers were read:

Simple Ammonia Apparatus for Temperatures to Minus 70° Centigrade: Professor C. F. Marvin, of the U. S. Weather Bureau.

The apparatus described and exhibited by the speaker was designed for general laboratory work wherever a liquid bath maintained at the desired low temperature could be made to answer the purpose.

The apparatus consisted of a large cylindrical copper tank about 11 inches in diameter and 13 inches high. This was jacketed all around, except on top, with thick wooden walls and an interlining of animal hair felt. Inside the copper tank was placed a ring-shaped iron ammonia flask made up of two short sections of standard iron pipe having annular heads at each end. The flask measures about 10 inches in diameter outside by 9 inches high, and 7 inches across the ring inside. The flask is supported centrally on three lugs inside the tank, and is provided with a suitable outlet pipe and valve at the top.

In use the tank is filled with alcohol or non-freezing liquid (about 3¼ gallons), and the flask charged (two thirds or more) with liquid ammonia (5 to 6 pounds). To lower the temperature, gaseous ammonia is allowed simply to escape slowly from the flask. The fumes may be led into a vessel of water with the formation of aqueous ammonia, or allowed to escape entirely. A strong circulation of the liquid of the bath is maintained by means of an efficient form of motor-driven stirrer.

The temperature can be lowered to —25° to —30° C., by the spontaneous evaporation and escape of the ammonia. For still lower temperatures it is necessary to use a suction pump to increase the evaporation by reduction of pressure. A simple hand pump was described for this purpose with the novel feature that the outlet valve opened directly into a water jacket space supplied with running water. Moreover, the valve itself had a small hole directly through it, so that water constantly leaked into the pump chamber and there absorbed large volumes of gaseous ammonia. When in operation, the object of working the piston of the pump up and down is quite as much to expel the water leaking into the pump chamber as to take off the gas, large quantities of which are absorbed by the fresh water entering the pump after each stroke.

An apparatus of this character has been used for many years at the Weather Bureau in the comparison of thermometers and other low temperature work, and was first described in Annual Report of the Chief Signal Officer, 1891–92, p. 355. The bath can readily be lowered to —40° C., and thermometer comparisons carried on over a period of four or five hours with an expenditure of not over five or six pounds of ammonia, which costs about $1.50. Experience demonstrates that in a small apparatus of the kind described, it is much more convenient and economical to let the ammonia escape after evaporation than to try to recondense it back to the liquid state. It proves to be quite practicable to carry the temperature down to —70° C., at which a number of thermometer comparisons have already been made.

Recent Gravity Work by the Coast and Geodetic Survey: WM. BOWIE, of the Coast and Geodetic Survey.

This paper gave an account of the gravity work done by the Coast and Geodetic Survey during the past few years. In 1891 the survey began the use of two sets of half-second pendulums which proved efficient and accurate in this relative determination of gravitation, using the gravity pier at the Coast and Geodetic Survey Office as the base station. As first constructed the knife edges were fastened to the head of the pendulum with the supporting planes on the pendulum case. Several years later this method was reversed, the planes being placed in the pendulum head and the knife edges on the case. This gave a more invariable length of the pendulum, as the effect of any wear on the planes would be negligible.

The different apparatus used in making the observations were illustrated by lantern slides. Previous to 1909 the relative value of the intensity of gravity had been determined at forty-seven stations in the United States. In that year a campaign of gravity work was begun and is still in progress. It will probably close at the end of the present year. During the past two and one half years fifty-six stations have been established. By the end of this year the intensity of gravity will have been determined at about twenty additional stations. This will make a total in the United States of about one hundred and twenty stations.

The apparatus and methods are sensibly the same as those used in previous work except that an interferometer was used for determining the flexure of the pendulum case due to the horizontal force applied by the swinging pendulum. This took the place of the static method. The interferometer had never been used previously in any country for determining flexure on the field.

In 1909 J. F. Hayford, the inspector of geodetic work in the Coast and Geodetic Survey, made an investigation of the effect of topography and isostatic compensation on the intensity of gravity, using fifty-six stations in the United States. He read a paper showing his results at the meeting of the International Geodetic Association at Cambridge and London in that year. By the application of the theory of isostasy the large anomalies between the theoretical and actual value of gravitation by the Bouguer and free air reductions were greatly reduced. The mean anomalies without regard to sign for the fifty-six stations were .064, .027 and .015 dyne for the Bouguer, free air and Hayford methods, respectively.

An analysis of the anomalies by the new method showed that there is only a slight, if any, connection between the size and sign of the anomaly and the character of the topography surrounding the station.

The results from this investigation confirm the conclusions arrived at by Mr. Hayford in his two investigations of the figure of the earth and isostasy. He and the speaker have nearly completed an enlargement of this investigation, using eighty-nine stations. It is expected that the results of this investigation will be published by the survey during the coming year. This investigation will verify the conclusions arrived at from the preliminary one. The work done by the Coast and Geodetic Survey proves that a close approximation to the condition of complete isostasy exists.

(The abstracts of the above papers are by their authors.)

R. L. Faris,
Secretary

THE AMERICAN CHEMICAL SOCIETY
NEW YORK SECTION

The eighth regular meeting of the session of 1910–11 was held at Rumford Hall on May 5. Professor Chas. Baskerville in the chair.

Resolutions were offered on the death of Mr. Bernard G. Amend.

The day of the meeting marked the centenary of the birth of John W. Draper and a committee was appointed to consider some fitting memorial celebration.

The following papers were presented:

"A Tetracetyl Glucosamine Glucoside," M. L. Hamlin.

"Studies on Amylase. III. Experiments on the Preparation and Properties of Pancreatic Amylase," H. C. Sherman and M. D. Schlesinger.

"The Lactic Acid Ester of Santalol and other Santalol Compounds," Frederick S. Mason.

"Electric Tube Furnaces with Calorite Resistors for Laboratory Use," S. A. Tucker.

"A New Rapid Method for the Determination of Manganese in Iron and Steel," F. J. Metzger and L. E. Marrs.

"The Oxidation of Ferrous Salts," Chas. Baskerville and Reston Stevenson.

"Contributions to the Chemistry of Anesthetics. III. Nitrous Oxide," Chas. Baskerville and Reston Stevenson.

C. M. Joyce,
Secretary

THE TORREY BOTANICAL CLUB

The meeting of March 29, 1911, was held at the museum building of the New York Botanical Garden at 3:30 P.M. Vice-president Barnhart occupied the chair. Thirteen persons were present.

The following communication from Miss Caroline C. Haynes was then read:

Sixteen East Thirty-sixth Street,
New York City.

Mr. Bernard O. Dodge,
Secretary and Treasurer,
Torrey Botanical Club, Columbia University.

Dear Sir: It is desired by a number of the members of the club and by others interested, to establish a fund in memory of the late Professor Lucien Marcus Underwood, the income of which may be used to aid in the illustration of the Club's publications. It is hoped that this fund may reach at least $5,000.

I ask that you obtain from the club its consent to administer such a fund, and enclose my check for $100, as an initial subscription drawn to the order of the Torrey Botanical Club.

Sincerely yours,
(Signed) (Miss) Caroline C. Haynes
February 15, 1911

Dr. M. A. Howe made a motion that the club establish a Lucien Marcus Underwood fund, the income of which shall be used in illustrating the publications of the club, and that the secretary be instructed to convey to Miss Haynes the hearty and appreciative thanks of the club for her generous initial subscription. The motion was unanimously adopted.

The resignations of Elizabeth Billings, Alice Knox, W. L. Sherwood and Rev. L. T. Chamberlain were read and accepted.

Dr. H. H. Rusby reported having received several acceptances to his invitations to become sustaining members of the club.

First on the announced scientific program was a paper on "Virginia Fungi" by Mr. B. O. Dodge. After reviewing the literature relating to Virginia fungi the speaker gave a report on the fungi collected on the estate of Mr. Graham F. Blandy at White Post, Clark County, Va., last September.

The second number on the program was on "A Little-known Mangrove from Panama," by Dr. M. A. Howe. The mangrove in question, *Pelliciera Rhizophoræ,* a member of the Tea or Camellia Family, was found in association with *Rhizophora, Aviunnia,* etc., near the Pacific terminus of the Panama Canal. Specimens and photographs were exhibited. A description and discussion of this mangrove will appear in the April number of the *Journal of the New York Botanical Garden.*

B. O. Dodge,
Secretary